HYGIENE AND PHYSICAL CULTURE

FOR WOMEN

GALBRAITH

HYGEIA, THE GODDESS OF HEALTH.

HYGIENE AND PHYSICAL CULTURE FOR WOMEN

BY

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"Yea, all that a man hath will he give for his life."
—JOB ii. 4

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I have examined the manuscript of Dr. Anna M. Galbraith's Treatise on Hygiene for Women with some care. I think it contains sound doctrine, well expressed. In my opinion, its wide circulation among the women of this country will be of service to their physical condition, and, so far as any recommendation of mine can go, I cheerfully commend it to the favorable consideration of the sex for whom it is written.

D. B. ST. JOHN ROOSA.

NEW YORK, November 29, 1894.

" Man is his own star ; and the soul that can
Render an honest and a perfect man,
Commands all light, all influence, all fate ;
Nothing to him falls early or too late.
Our acts our angels are, or good or ill,
Our fatal shadows that walk by us still."

—*Epilogue to Beaumont and Fletcher's*
" *Honest Man's Fortune.*"

PREFACE.

THE writer ventures to offer this little volume to the public as the result of her personal investigation, observation, and the collated wisdom of many eminent authorities.

The need of it was felt in the many years of her student life, as well as since then in her professional life, to combat the ignorance shown by the masses of otherwise well-educated women, in regard to all functions of the human body, so that in girlhood many follies are committed that render the woman's life well-nigh a burden.

This work has been in preparation for six years, and all accessible works bearing on the subject have been carefully studied. The works of the most noted anatomists, physiologists, hygienists, as well as those of the most eminent authorities on the diseases of women, have been freely drawn upon, since many of them are inaccessible to the general reader; while by means of profuse illus-

trations the writer has endeavored to further elucidate her subject.

This little book will have accomplished its end if it arouses woman to extend her studies on the subjects discussed, and to bend her thoughts and energies to the emancipation of her sex from the bondage of invalidism.

A. M. G.

NEW YORK, *November, 1894.*

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INTRODUCTION.

"We are weak, because it never enters into our thoughts that we might be strong."—SALZMANN.

THERE was a time, you know, so far back in the history of our race that it is now called the Age of Fable, when Hygeia lived on the earth. Her father was Æsculapius, the Father of Medicine. He was not only the founder of the healing art, but he acquired so great a knowledge of herbs and surgery that, besides curing the sick, wounded, and dying, he actually restored the dead to life. Zeus fearing that this dread rival would render mortals independent of the Gods, smote Æsculapius with a thunderbolt, and afterward received him, being also the son of Apollo, into Olympus, among the number of the Gods.

Æsculapius at his apotheosis left two sons, Machaôn and Podalirius, and a virgin daughter, Hygeia. The first became noted as a surgeon, while the second gained renown by the healing of

disease through medicine. But to-day we know that Hygeia was the greatest of the three, since she taught how disease could be prevented.

Of her life we know but little. After she was called to the Home of the Gods, temples and statues, such as you see in the frontispiece, were erected to her. In her hand she holds the cup of bounty; and that not to us pleasant looking serpent which is coiled about her arm is the emblem of foresight, wisdom, and eternity.

But Hygeia had left written on parchment ponderous volumes, teaching how to attain the perfect development of body and mind, how to maintain this period of beauty and vigor, so that the harmonious action of body and mind might be prolonged until death occurred, not as the result of disease, but the natural dissolution of a ripe old age.

In the ages which followed, Hygeia had many noble expounders, hence the Age of Beauty of the Greeks. Women were very learned, and in those ancient universities of Alexandria, Bologna, etc., for many centuries learned ladies lectured in professors' chairs.

This was followed by the terrible Dark Ages, from 476 A. D. to 1492. The great libraries were

burned down by the barbarians, and the most gross ignorance prevailed. The nobles with their vast retinue of attendants went to the Wars of the Crusade, while their wives buckled on their armor, and embroidered tapestries and banners. And neither lords nor ladies knew how to read or write. The priests formed the only leisure class, and learning became confined to the monasteries. In the meantime those books of Hygeia's had been forgotten, and the most dreadful plagues swept over and devastated Europe.

But with the art of printing, men again became more generally educated, and as education increased, Hygiene, for that was the name of the work, became more practiced *among men.* So ponderous have been the most of these books, so weighed down by technical and scientific terms and statistics, that like the chained Bibles of the Middle Ages they have been accessible only to the learned few.

As the natural result of the state of affairs brought about by the Dark Ages, woman was obliged to take her position, not beside man, but at his feet, as his pupil. Being taught by him, for the most part she looks at life through his glasses. Unfortunately the finest lenses are not

accessible to the masses. She has accepted as an axiom, among other popular fallacies, that "her ill-health is natural, that she is the victim of functions whose exercise constitutes a sort of invalidism."

That the cause of her weakness does not lie in the performance of her functions has repeatedly been attested by our most eminent medical authorities. Professor T. Gaillard Thomas says ("A Practical Treatise on the Diseases of Women," Fifth Edition, p. 41): "If we compare the present state of women in refined society over the world with that of the working peasants of the same latitudes, or with the North American squaws, or the powerful negresses of the Southern States, we can with difficulty believe that they all sprang from the same parent stem, and originally possessed the same physical capacities. Observation shows that women who are not exposed to depreciating influences can compete with the men of their races, and in savage countries they are sometimes regarded as superior to them. In the lower orders of animals this equality is still more marked. The mare endures as much as the horse, and some of our most celebrated racers have represented the female sex,

The lioness is fully as dangerous to the hunter as her more majestic consort, and the bitch proves as untiring in the chase as the most muscular dog in the pack.

"From all these facts we may logically argue that the human female, if properly developed and placed beyond causes which militate against her physical well-being, would be in no great degree the inferior of the male. This position I now assume, and maintain that the customs of civilized life have depreciated her powers of endurance and capacity for resisting disease."

Dr. Kellogg says ("The Influence of Dress in Producing the Physical Decadence of the American Woman") "that travelers in China are constantly astonished at the immense load that Chinese women carry on their shoulders. And that in Naples, Italy, he had seen a woman carry off upon her head an immense load of vegetables, which had required two men to lift into position. De Saussure relates that when he had finished his observations in the valley of the Zermatt, he packed a collection of mineralogical specimens in a box, and called for a porter to carry it out of the valley, as the mountain roads were too steep for it to be carried by four-footed animals of any

sort. After a fruitless search for a man who was able to carry his box of specimens, he was finally told, if he wished a porter to carry them, he must employ a woman, as no man could be found who was able even to lift the box. He accordingly engaged a woman who offered herself for the service, and stated that she carried the heavy box of minerals over the steep mountain roads without the slightest injury either to it or to herself. Stanley reports that the two hundred women porters whom he employed on one of his expeditions proved to be the best porters he ever had in Africa."

To the American resident of Vienna, the sight of the peasant women as hod-carriers going up ladders with their heavy burdens is a familiar one; and many of them continue at these heavy labors until the very day of their confinement.

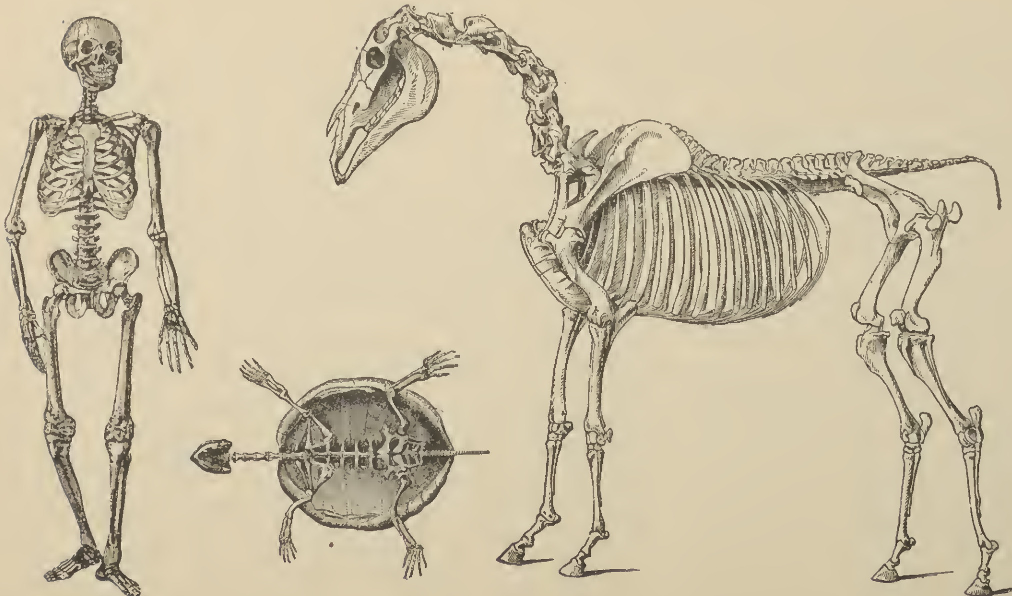
Dio Lewis (The Health of American Women, North American Review, 1882, pp. 135–503), relates that William Crafts, who resided for twelve years in Dahomey, Africa, said that the Dahomey women are quite as large and strong as the men, and manage the business affairs of the country. In conversation with one of the king's bodyguard, a stalwart Amazon, he asked what she thought of men as soldiers. "Men can't fight. We three thousand women of the king's

bodyguard would like to meet six thousand men; we'd show them how to fight."

The vital question now is, Can the civilized woman of to-day overcome the physical deterioration which has been imposed upon her by heredity, her own dress, and mode of life? Hygeia answers emphatically Yes! and will show you how this consummation, devoutly to be wished for, may be attained.

For, as Hygeia went up and down the face of the earth, from country to country, from city to city, from town to village, she considered the daughters of men, what universal and needless sufferings and bodily afflictions they had brought upon themselves through ignorance and folly; ay! even opprobrium upon their sex, so that a learned man once said: "The world is but one vast hospital for women, where every kindly deed done one of them is a favor to an invalid." And though they did but justly suffer, since they reaped what they had sown, this beneficent though very jealous goddess, that none might suffer ignorantly, sent hither her hierophant to declare these things unto you. Listen well then, for,

"The Gods implore not, plead not, pity not,
They only offer time and occasion, which being once refused
Returns no more."



OUR FRAMEWORK.

HYGIENE AND PHYSICAL CULTURE.

CHAPTER I.

The Bony Skeleton, its Uses and Abuses—The Skull and Spinal Column Viewed in Connection with their Contents, the Brain and Nervous System—Artificial Deformities of the Head and Foot, with a Description of a Perfect Foot.

> "O wad some pow'r the giftie gie us
> To see oursel's as others see us!
> It wad frae monie a blunder free us,
> And foolish notion."
>
> —Robert Burns.

In order that woman may again attain to the most perfect development of body and mind, and maintain this period of beauty and vigor with the prolonged harmonious action of body and mind until a ripe old age, she must adhere rigidly in letter and in spirit to three of Hygeia's chief laws: namely, of Dress, Exercise, and Food.

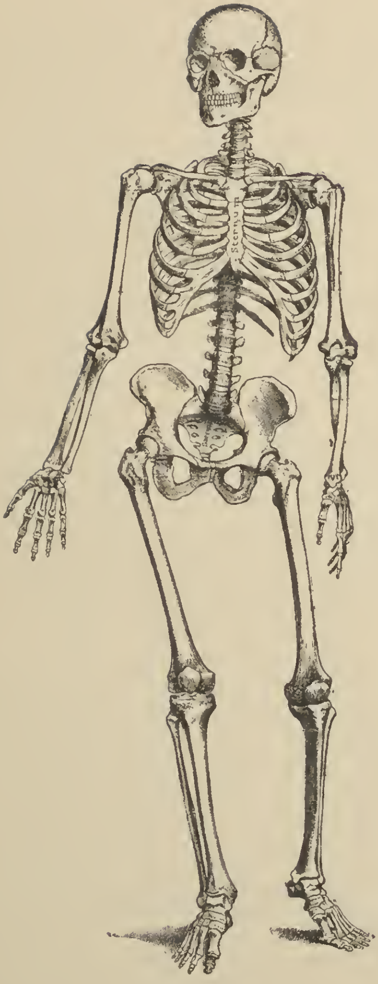
Now, in order to clothe the body in accordance with the laws of nature, she must first know the kind of a body nature has given her, of what it consists, and how it is constructed. When she

has thoroughly mastered this first and fundamental principle, she must next consider what kinds of exercise and food will best maintain perfect symmetry of body and mind—which was the true secret of the great beauty of the Greeks. To this end a slight knowledge of anatomy and physiology is essential.

When you are feeling your "bluest," nothing is more certain than that some mournful croaker will sadly shake her head and add to your low frame of mind by the trite old saying: "Yes, there *certainly is* a skeleton in every closet." To which I add: and what is more, each of us carries her skeleton with her wherever she goes, be it to the ballroom or to church. And, further, I aver that this skeleton is the very making of us, and without it our life would be impossible.

The physical body is, as it were, an animated mechanism or machine. The only laws we can comprehend about it are purely chemical and mechanical. The machine is made, wound up, if you will, like a clock; life is breathed into it by the Creator; it goes until it is run down, when it stops; in common parlance we say life is extinct.

Or again, the human body may be likened to a house. After the plan has been made and the



THE HUMAN SKELETON.

foundation laid, the framework is erected, and this last determines the size of the house, the height and the shape or style, as to whether "Gothic," "Queen Anne," etc. And on the solidity of the framework will depend to a great extent the worth of the building.

For the human being, the plan has been made by the Creator; our ancestors have pretty thoroughly laid the foundations, so we will begin by an examination of the skeleton on which you and I are built.

A glance at our illustration shows that by looking at a skeleton we can tell to what kind of an animal it belonged; what the habits of the animal were—that is, whether it walked on two feet or on four, or whether it crawled.

Like the framework of a house, so the human framework or skeleton determines the general shape and height of the individual, gives the body solidity, and is divided into rooms or compartments which form safe receptacles for delicate organs. For bone, you know, is the hardest structure found in the human body, while at the same time it possesses a certain degree of toughness and elasticity.

A glance at the figure shows that in the human

skeleton there are four bony compartments, and on learning what each contains you will recognize at once how admirably adapted each compartment is to the most perfect development and protection of its contents. You will see as we go on, that in these cavities are contained all those organs which are essential to life and the reproduction of the race.

We will begin with the skull, because its cavity contains and protects the brain, which is not only the most delicate and complicated organ in the whole body, but because it is the master organ and controls the whole. It is now regarded that the hemispheres of the brain are the seat of the mental faculties, perception, memory, thought, volition, etc. The brain, spinal column, and nerves constitute the so-called nervous system. This has been likened to the electric telegraph; the brain being the central station, while the nerves serve simply as conductors, just as the wires do. Besides the special senses, there are many terminal sub-stations in the skin; all these keep the brain informed of what is going on in the world around it; and the various internal organs of the body are provided with similar sub-stations to send word to the brain how matters

a. UPPER SURFACE OF THE BRAIN.

b. UNDER SURFACE OF THE BRAIN.

c. MEDIAN SECTION OF THE BRAIN.

are going with them. The body is supplied with two distinct sets of nerves or wires, one of which carries messages from the outside world and

1, 2. The Brain.
3. The Spinal Cord.
4. Nerves to Upper Extremities.
5. Nerves to Lower Extremities.

various organs to the brain, while the other set transmits the orders from the brain.

That aperture which you see at the base of the

skull is for the transmission of the spinal cord, which is a continuation downward from the brain through the spinal canal. The spinal cord is the center of reflex acts; that is, if you touch the leg of a brainless frog with acid he will take another leg to wipe it off with. What really takes place is as follows: There are, as we have seen, sub-stations in the skin, hence the acid causes the sensation of a foreign body; word is telegraphed the spinal cord, where there is a large central station; from here word is sent out by another set of nerves to move the leg away from the acid, but this being insufficient, word is telegraphed another leg to wipe off the offending substance. Did the same thing happen in the human body, at the same time that the spinal cord telegraphed word to the affected member to withdraw it, it would telegraph to the brain and a perception of pain would be felt. But more than this the brain causes the various parts of the body to act together or to suppress action altogether. A baby's brain is less well developed and does not possess this so called inhibitory power. Again, when women work too hard and are exhausted—reach a state which we call nervous prostration—these inhibitory centers become weakened and

the woman becomes hysterical ; that is, she gives way to fits of laughing or crying if anyone speaks to her.

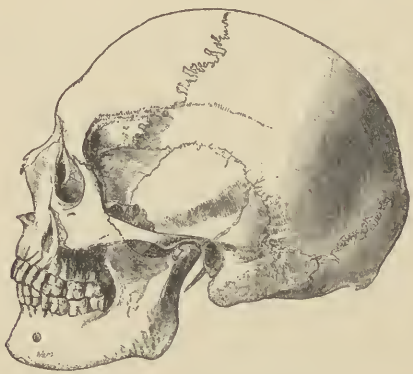
A message travels along a nerve at the rate of about thirty-six yards a second, or a mile a minute. This is about the time made by a lightning express train. The distances in the body being so short, the time taken is imperceptible, and we say that movement is instantaneous.

The paths traveled by the nerve impulses are made passable by use ; the oftener an impulse traverses a given route, the more adapted such a route becomes for future traffic.

But all this has to do with nerves which are under the control of the will. There is another set of telegraph wires in the body called the sympathetic or vegetative system, so called because it presides over the processes of nutrition and is beyond the control of the will.

The hard, inseparable bony skull of the adult is as solid and compact as if it were formed of a single bone, instead of twenty-two. If you will examine the head of a young baby you will find that it feels very differently. The bones are soft, you can push them about, and in several spots, notably on the top of the head, anteriorly, there is

a soft diamond-shaped space. At birth the bones are connected by a tough membrane to allow for the growth of the brain. So brain and skull grow apace until adult life is reached, when the bones,



SIDE VIEW OF THE SKULL.

which have gradually been becoming harder, are united to form one solid piece. Those forming the exterior of the cranial cavity are thin and flat, having dentated or saw-like edges, which fit into each other like building blocks; these finally become so firmly united that they cannot be separated. There is only one opening of any considable size in the skull, this is at the base; and is, as you have been told, for the transmission of the spinal cord. The other small orifices are for the

passage of nerves to the various parts of the body.

We naturally pass next to a consideration of the spinal column, which supports the weight of the head, and forms a canal for the protection of the spinal cord. This spine or back-bone is the sharp ridge which is felt at the middle of the back. It enters into the formation of the two remaining bony compartments of the body, the chest and pelvis. It is, in short, the key-stone which supports and binds the whole body together. The spinal column is, as you see, not a straight hollow rod, but is curved and slightly flexible. This is due to the fact that the spinal column does not consist of a single bone, but is made up of thirty-three bones, set one upon another. These bones are called vertebræ. The front part of each bone is solid,

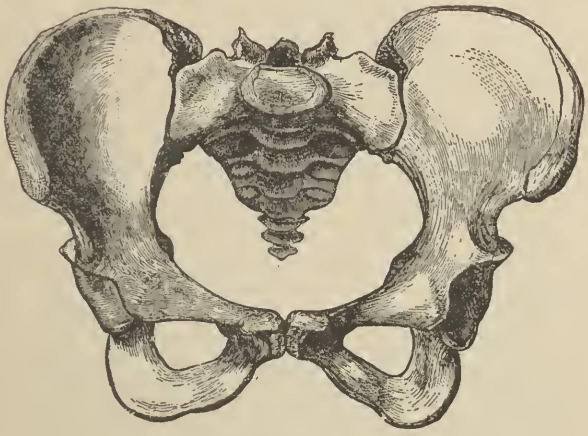
LATERAL VIEW OF THE SPINE.

yet light and spongy in texture, while the back part is hollow and forms a ring. Now, when these bones are put together, you see a canal must be formed, and the spinal cord passes through and is protected by this bony canal. The flexibility of the spinal column is increased by the elastic cartilage which is placed between the vertebræ and serves as a cushion; this also greatly diminishes the shock of a fall, as when the feet suddenly fly out from under one who is skating. The skull and spinal column are the only compartments that are wholly composed of bone, and this we have seen is necessitated by the extreme delicacy of their contents. The three remaining compartments of the body are composed partly of bone, partly of muscle. The proportions and arrangements of each depend on the functions of the organs which they contain.

A SINGLE VERTEBRA.

The pelvis is a somewhat basin-shaped cavity

found at the lower end of the spinal column. This is formed at the back by the lower end of the spinal column, while two large flat bones form the front and sides. In the adult this be-



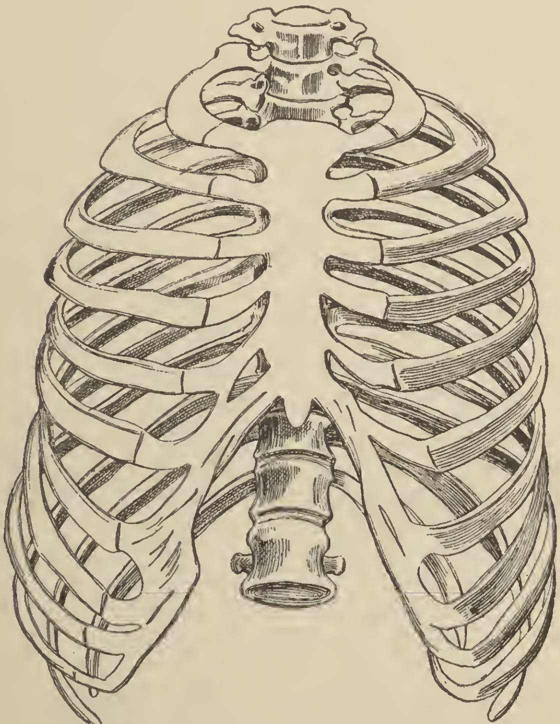
FEMALE PELVIS.

comes practically almost as solidly grown together as the bones of the skull. But there is this very essential difference: the bottom of the pelvic basin is closed by muscles, while the top is filled in with loose structures. You will readily understand the necessity for such an arrangement as this, when you learn that in this cavity are found the bladder, the lower end of the large bowel, and the reproductive organs. The flaring

edges seen in the illustration are the hips. In woman the pelvis is broader and the hips more flaring than in man.

The fourth and last bony cavity, the chest or thorax, forms a marked contrast to the hard immovable skull and pelvis. Here you see simply a bony cage, whose base is filled in by one large flat muscle, the diaphragm. The chest or thorax is formed in the back by twelve vertebræ, and from each vertebræ a pair of ribs pass around to the front, but instead of forming a joint with the breast-bone, a piece of elastic cartilage unites the seven upper ribs with the breast-bone, while the cartilage of the eighth, ninth, and tenth are simply attached to the cartilages of the preceding ribs; the eleventh and twelfth ribs are free at their anterior extremities, and form the so-called floating ribs. It should be noted here that the bony thorax is cone shaped; that it is distensible, but that the distensibility increases from above downward, and is greatest at the base. The thorax contains and is completely filled by the heart, lungs, and great blood-vessels. When we come to study the mechanism of respiration and the circulation, we shall find that anything which tends to impair the distensibility of this

life-containing cage works the greatest injury possible to the individual. Thus far we have



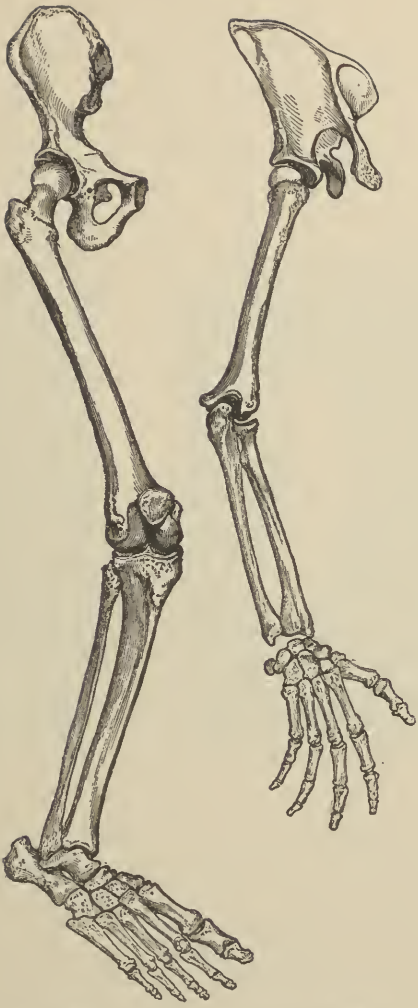
THE BONY THORAX.

only considered that part of the bony skeleton which enters into the formation of the cavities or compartments of the body, namely, the head and

trunk. Now, while life would be possible, since we have here all the vital organs, still the human torso would be a very pitiable affair without its extremities. And this brings us to a consideration of the arms and legs.

In looking at the arm and leg of the skeleton, we find that the structure or arrangement of the bones is the same in both; that is, the arm and leg are said to be homologous. There are the same number and the same kind of joints, with just one bone more in the upper than in the lower extremity. The arm has three long bones arranged in two sets, one in the arm and two in the fore-arm. Each long bone consists of a hollow cylinder expanding into two extremities, each end being made to fit into the corresponding end of the adjoining bone or bones. The two bones of the fore-arm enter into the formation of the wrist and elbow joints. These are both so-called hinge-joints; the only motion possible is opening and closing like a door. We find the same kind of joints at the ankle and knee. Since at the wrist strength is needed with limited motion, we find here short bones placed compactly.

The arrangement of the bones of the leg and



HOMOLOGY OF THE LEG AND ARM.

foot is precisely the same as that found in the arm and hand, except that the knee joint is protected by a bone placed in front of it. The ends of the bones are held together by strong elastic bands which surround the joints; the bands

THIGH-BONE—LENGTHWISE AND SAWN ACROSS.

or ligaments, as they are called, being lined by by a membrane which pours out a fluid to lubricate the parts.

The end of the arm-bone which enters into the formation of the shoulder-joint is of an entirely different shape. It has a round ball-like end or

head, which is received into a corresponding depression in the shoulder-blade, and is held there by strong elastic ligaments. This is called a ball and socket joint, and allows motion in every direction. There is precisely the same kind of joint at the hip.

As we proceed in our studies of the skeleton we cannot fail to be impressed with its marvelous construction, and the perfect adaptability of each part for its intended purpose.

Yet so wonderful is this man when put together, so great is the ingenuity, and so many and varied are the imaginings of his fertile brain, that every civilized nation of the globe from time immemorial has boasted that the men, and latterly more especially the women, of its race have conceived methods of improving on the original plan. That is, the creature has said to the Creator, "Had you given me a differently shaped head, waist, or foot, I would have been much more beautiful than I am to-day." For the different ages and the different races have not agreed as to just where the defect lay; and these have been the three chief points attacked.

We will pass over those minor devices which have at various times been resorted to, and

SCAPULA, OR SHOULDER-BLADE.

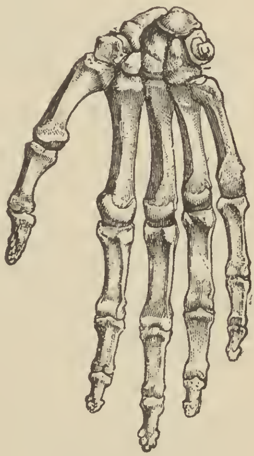
CLAVICLE, OR
COLLAR-BONE.

HUMERUS, OR
ARM-BONE.

ULNA AND RADIUS, OR
BONES OF FORE-ARM.

chiefly among savage races, for the beautifying of the body; they were for the most part confined to the skin and its appendages; as bleaching the hair, the eradication of the eye-brows,

BONES OF WRIST.



BONES OF HAND.

tatooing the skin, boring the ears, nose, and lips for the insertion of ornaments.

One of the most ancient and wide-spread customs with which we are acquainted is that of artificially changing the shape of the head. Hippocrates, writing 400 B. C., De Aëre, Aquis, et Locis, says of the people dwelling near the sea of Azov: "They think those the most beauti-

ful who have the longest heads. Immediately after the child is born, and while its head is still tender, they fashion it with their hands, and constrain it to assume a lengthened shape by applying bandages and other suitable contrivances, whereby the spherical form of the head is destroyed and it is made to increase in length. Thus at first usage operated so that this shape was the result of force; but in the course of time it was formed naturally, and usage had nothing to do with it." This same custom of distorting the shape of the head has been practiced among the Chinese to a small extent, also among the North American Indians, and many other races; but it has for the most part been confined to savage nations. While to the man of the most advanced civilization belongs alone the credit of devising many methods for beautifying the foot, by preventing its growth and development.

The foot forms the base of support for the entire body, and at every step it is subjected to a pressure of from one to two hundred pounds. This base is in the form of two arches, a transverse and antero-posterior. The latter is the most important and has been sub-divided into two by an imaginary line drawn between the


HIP-JOINT.


FEMUR, OR THIGH-BONE.


FIBULA AND TIBIA, OR BONES OF LEG.

third and fourth metatarsal bones. The inner portion of this arch is much more curved than the outer, and forms the instep. The arch is supported by two piers. The posterior pier is

UPPER SURFACE, BONES OF FOOT.

formed by the os calcis or heel-bone, and the posterior part of the astragalus; it is shorter, has but one joint, is more curved, and at the same time more solid, than the anterior pier, and receives the greater part of the weight of the

body. The anterior pier includes all the bones in front of the astragalus to the junction of the three inner metatarsal bones with the toes. It is much the longer, is less curved, and has many joints, giving it greater elasticity and also enables it to diminish the force of shocks transmitted to the arch. The summit of the arch is at the ankle. The length of the foot should be one-seventh of the woman's height. It is evident

BONES OF FOOT, IN PROFILE.

that the superincumbent pressure, by flattening the arches, both lengthens and broadens the foot. The antero-posterior arch is further lengthened by a turning upward of the toes which form a hinge-joint with the instep.

The foot in extension rests normally upon the heel, the tips of the metatarsal bones, and the outer side of the sole. In walking, running, or dancing, the direction of the weight upon the arches is constantly changing; and it is only

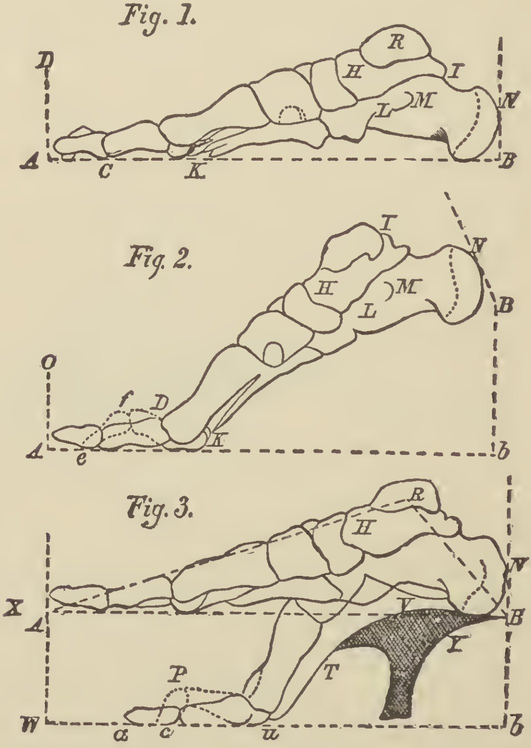
through the action of certain muscles that the normal arches are conserved. This healthy condition of the plantar arch can only be maintained by the evenly balanced action of those muscles which surround and strengthen the weak parts of the arch.

Dr. Busey's classic description of the movements of the foot in walking is as follows: *

" In walking, the heel touches the ground first, and supports (Onimus) the whole weight of the body for a moment. A little later the point of the foot touches, and assists in preserving the equilibrium by increasing the base. During the second movement of walking the heel is raised (see figs. 2 and 3), and the weight of the body is shifted more and more to the center of the foot and to the toes, the latter spreading and pushing the body forward. This last is the movement which displays to the greatest advantage the suppleness and elasticity of the articulations of the foot, and the adaptation of the arch to receive the weight of the body and to transfer it to its distal pier, while the body is being moved forward by the same act. It is the execu-

*S. C. Busey, M. D.: Influence of Constant Use of High-heeled French Shoes upon the Female Form, etc.

tion of this movement which gives to the gait of woman that elegance and those graceful modula-



THE NATURAL AND ARTIFICAL POSITIONS OF THE FOOT.

tions which are so attractive. While on the other hand the high- and narrow-heeled shoes, by displacing the supporting base, cause both piers

of the double-spanned arch to strike the ground simultaneously. So the gait, instead of being undulating, is stiff and hobbling, and the body advances by jerks.

"When standing, the heel-bone (N M I, fig. 1), the joint at K, and the great toe A C, touch the support upon the line A B. When the feet are shod according to the present fashion, the line A B is made to assume the concave form shown in fig. 3 by V T *u*. The instep is made more convex and rounded, and the foot is actually shortened. (See A B, figs. 1 and 2.) The constant elevation of the heel places the body of the pedestrian in the same position as when standing upon an inclined plane. Again, the heel is so shaped and located (Dowie) that it forces up the key-stone of the arch, and weakens the whole structure."

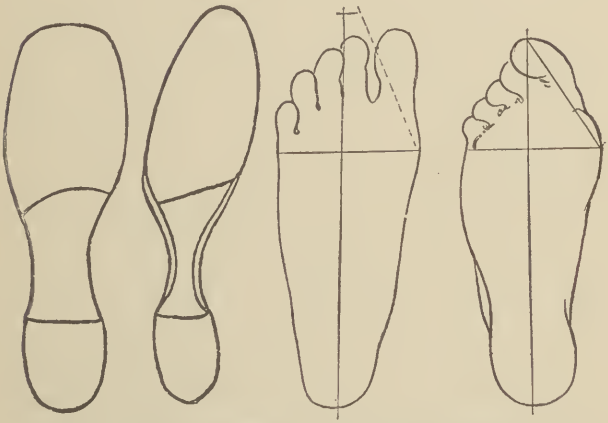
The compression of the foot into a rigid body not unlike a shoemaker's last, destroys the natural relation of the parts, prevents the growth, interferes with the circulation, compresses the nerves, weakens muscles and ligaments which should support the arch, and is the prolific source of corns, bunions, weak ankles, and "flat foot."

But, in addition to the direct injuries to the

feet, the excessive elevation of the heel displaces the center of gravity, and transfers the weight of the body for the most part from the heel to the line of union of the instep with the toes, a series of joints with shallow sockets not formed to bear the brunt of the body-weight. Besides which, the equilibrium of the body can only be maintained by an increase of the natural curves of the bony frame-work. With the resulting increased curvature forward at the small of the back, is an increase in the prominence of the buttocks and abdomen. This tilting backward of the pelvis interferes with the circulation of the pelvic organs, uterus, ovaries, etc., and congestion and inflammation of these organs follow.

The Chinese begin applying tight bandages about the feet of girls at five years of age. By this means they secure not only an alteration of the relative position of bones and other structures, but an actual arrest of their development. The foot eventually has the four outer toes turned under the sole, so that the first or great toe alone retains its normal position, and a narrow point is produced in front; there is, of course, also a compression of the roots of the toes and the entire foot.

Fashion with us is somewhat different in this respect. It has decreed that the French shoe, with its high heel and pointed toe, alone is mode.



SOLE OF SHOE FOR NORMAL AND ARTIFICIAL SHAPE OF FOOT.

And, "Was nicht Mode ist, ist nicht schön." That is, the shape of the foot must be adapted to the shape of the shoe. If you are not prepared to accept this statement, disabuse your mind by comparing the imprint of your bare foot on the wet sand with the sole of your shoe.

In the next place, after a woman has reached a certain sized shoe, she positively refuses to wear anything larger. She forgets that the size of the

foot increases with use, as does every muscle and every part of the body. She has also forgotten the laws of symmetry upon which all true beauty depends. Indeed, it often seems as if the modern woman did not think at all, but leaves all that to her various modistes, boot-makers, tailors, and milliners, into whose hands she gives the various parts of her body to be molded like plastic clay.

The twenty-six bones and twenty-six joints of the foot have become converted into one hundred and four centers of agony and pain. Woman gives up almost all exercise because it is an exquisite torture. With the foundation destroyed, what can befall the house but utter ruin? Different specialists tell us of different maladies for which this same French shoe is responsible. The surgeon, of the painful operations it has necessitated on the foot; the gynecologist, of the displaced uterus with all its attendant evils; the general physician, of chronic dyspepsia, thinness of the blood, and kidney disease produced by lack of exercise, given up, forsooth, because walking with these deformed members was all too painful. And Brown-Séquard told of a patient who, whenever he bore

the weight of the body on the right great toe, became violently insane. He was cured by a surgical operation on the foot.

Woman has ever been heroic to endure suffering, and the end of the nineteenth century woman is in this respect in no way inferior. She has gladly endured all this suffering for the sake of beauty!

Does she who is surrounded with art not know the artists' verdict, that "every foot that has worn a shoe is deformed"? When the artist wishes to make a study of the foot, he goes off to the shores of Italy, where the peasant women have never worn shoes.

Paget's description of a perfect female foot is "Great breadth and fullness of instep, a well-marked great toe, a long second toe, projecting a little beyond the great toe, and a very small, or in some cases almost suppressed little toe."

Mrs. Haweis (The Art of Beauty), on seeing the play of Pygmalion and Galatea, in which the actresses were thinly stockinged, with sandals beneath the feet, and an embroidered strap coming between the two first toes across the instep after the Roman fashion, was so struck with the beauty of the movement and the gracefulness of

the lines from the ankle in every position, that she advocated the re-introduction of the Greek sandal. "For," she argues, "in reality we lose nearly as much by the shoe as the face loses by a mask; cover the hands with patent leather or lined French kid, and then expect them to entrance the spectator. The leathern case of a woman's foot is about as expressive of her foot as a violin case is of a fine violin. If women only knew the fascinations of the foot whose outlines had not been impaired by corns, nor the bones by generations of deformity, no shoe would be worn again forever."

"It is a wondrous thing, the human foot" (George Du Maurier, Trilby, Harpers' Monthly, January, 1894), "like the human hand; even more so, perhaps; but unlike the hand, with which we are so familiar, it is seldom a thing of beauty in civilized adults who go about in leather boots or shoes.

"So it is hidden away in disgrace, a thing to be thrust out of sight and be forgotten. And all for the sake of a high heel and a ridiculously pointed toe.

"Nothing else that Mother Nature has to show, not even the human face divine, has more subtle

power to suggest high physical distinction, happy evolution, and supreme development; the lordship of man over beast, the lordship of man over man, the lordship of woman over all!"

Contrast with this artist's flight in the adoration of the human foot, the description of Amelie Rives (The Witness of the Sun, April, 1889), which is not so much a caricature but that we are all familiar with it: "Her big limbs ended in the tiny hands and feet which are the ideal of beauty with so many women. As a little girl, Natalie possessed the arms of a well stuffed chair and the legs of a piano. As a young lady, voluminous sleeves and draperies only permitted one to observe hands which corresponded to the little tassels which usually finish off chair-arms, and feet not much larger than the castors in which piano-legs always terminate."

"The gorilla, ourang-outang, and other tailless apes, walk on their toes, so it would seem that a reversion to ancestral types is aimed at."—CHARLES MOORE JESSOP, M. R. C. P.

JUNO.

CHAPTER II.

The Key to Physical Beauty—Relative Proportions of a Perfect Female Form—The Muscular System—Outdoor Exercises: Walking, Running, Rowing, Bicycling, Swimming, etc., and Gymnastics, and what they will Do to Develop the Form and Restore the Health.

> "Men at some time are masters of their fates:
> The fault, dear Brutus, is not in our stars,
> But in ourselves, that we are underlings."
> —*Julius Cæsar*, Act i. sc. 2.

> "Health is the vital principle of bliss,
> And exercise of health."
> —THOMPSON.

"The ill-health of women is due to the fact that they are too constantly in contact with chairs."—MME. DE SÉVIGNÉ.

TO the perfect development of the muscular system is due the greatest beauty of the human body, as is proved by the fact that the Venuses, Junos, Dianas, Minervas, Niobes, in short, the most beautiful statues the world has ever seen, were made in Greece at a day when the systematic physical training began in infancy, and the gymnasium was a resort for the citizen of all ages.

The greatest attention to the physical development of her citizens was given in Sparta. Girls and young women were subjected to a similar, though less severe, training than men and boys. It included running, leaping, wrestling, and throwing the lance; these formed the favorite contests in the national games. Xenophon says: "The Spartans are the healthiest of all the Greeks, and among them are found the finest men and the handsomest women in Greece."

History, as well as these magnificent legacies in marble and on canvas, teaches us that no greater fallacy could be imagined than that "we are women and therefore weak." Among the Teutonic tribes the women frequently accompanied their husbands to war, and exhibited instances of the most daring bravery. In "The Fall of the Nibelungen" we are told that the conditions upon which the "Good King Günther" won the the hand of the beautiful Brünhilde, were, that at the peril of his life, he should vanquish her in hurling the spear, casting the stone, and leaping after the stone as it was thrown; also how he succeeded only with the assistance of his noble friend Siegfried.

This magnificent physique does not come un-

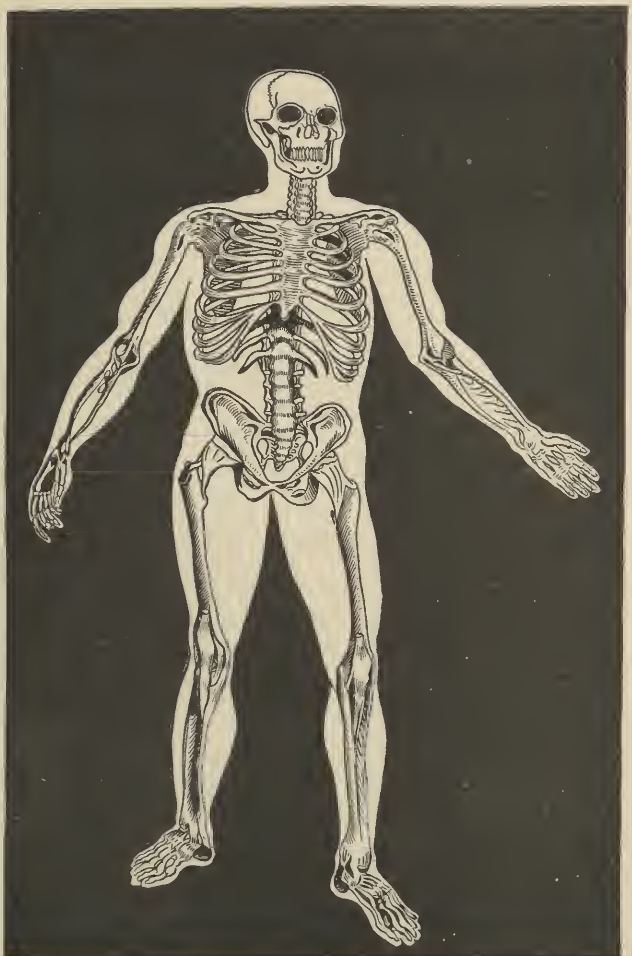
sought, nor can it be bought with wealth; it can only be attained gradually by hard work. Prof. Eliot said that the majority of students on entering Harvard had undeveloped muscles, a bad carriage, an impaired digestion, without skill in outdoor games, and unable to ride, row, swim, or shoot. "One-half the struggle for physical training has been won when the person can be induced to take a genuine interest in his bodily condition, to want to remedy his defects, and to pride himself on the purity of his skin, the firmness of his muscles, and the uprightness of his figure."

First we must know what the ideal to be aimed at is, and second what are the means by which it may be attained.

The relative proportions of a perfect female form, as deduced by modern sculptors from the Greek statues, are as follows: With a height of 5 ft. 5 in., the weight should be 138 pounds. She should, with the arms extended, from tip to tip of the middle finger measure 5 ft. 5 in., that is, exactly her own height. The length of the hand should be one-tenth, the foot one-seventh, and the diameter of the chest one-fifth that of the height. From the perineum to the ground she should

measure just what she measures from the perineum to the top of the head. The knee should come exactly midway between the perineum and the heel. The distance from the elbow to the middle finger should be the same as the distance from the elbow to the middle of the chest. From the top of the head to the chin should just be the length of the foot, and there should be the same distance between the chin and the armpits. A woman of this height should measure 29 inches around the waist, 34 inches around the bust if taken under the arms, 43 inches if measured over them. The upper arm should measure 13 inches and the wrist 6 inches. The calf of the leg should measure 14½ inches, the thigh 25 inches, and the ankle 8 inches.

We have seen that the bony skeleton forms simply the framework of the body: compartments for the protection of delicate organs—a series of levers with points of attachment for the muscles, so that motion becomes possible. And while it determines the general outlines of the body and the height, the weight and general size of the of the body depend upon the muscular development and the amount of adipose tissue. That is, the bones are padded about with muscles, the so-



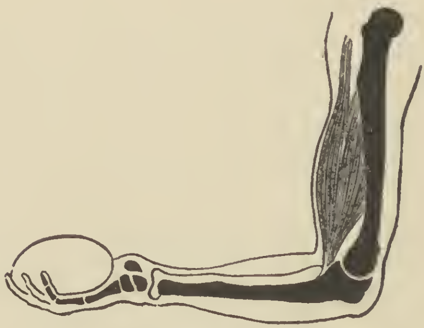
RELATION OF SKELETON TO MUSCULAR SYSTEM.

called flesh, and these again have their inequalities filled out with fat. So that the rotundity of the body is due to the amount of adipose tissue or fat.

When the skin and adipose tissue are removed from a body, the whole looks like a conglomerate mass of flesh. Upon closer examination, it is found that this apparent homogeneous mass is made up of individual muscles, just as the walls of a house are made of individual stones, and these, like the stones, vary in size and shape according to the part of the wall for which they are intended. As we saw, the long bones were found in the arms and legs, so here too are found the longest muscles.

Looking at a muscle, you would probably describe it as a dark red piece of flesh, thickest in the middle and tapering toward the ends, where it terminates in white, glistening, band-like strips of sinew. The red forms the working part of the muscle, while the white end is attached to bones, cartilage, or skin, as the case may be. Take for example the biceps muscle, which forms the bulk of the anterior part of the upper arm. The upper extremity of this muscle is attached to the shoulder, while the lower end is attached to one

of the bones of the fore-arm. The chief use of the biceps is to bend the fore-arm on the arm. It is evident that with the shoulder fixed, a



BICEPS MUSCLE.

shortening of this muscle must raise the fore-arm and so cause the bend of the elbow. In the elbow we find an example of a hinge-joint, as well as at the wrist, knee, and ankle, fingers, and toes. Now, the muscles that cause the bending of these joints are called flexors; there is another group of muscles working on the other side of the joint whose duty it is to extend the joint, and these muscles are called extensors. Nearly all the muscles of the body and limbs are arranged in two different sets, and are placed on the opposite sides of the part, so that in acting they

move the limb in opposite directions. And it is by the alternate contraction or shortening and

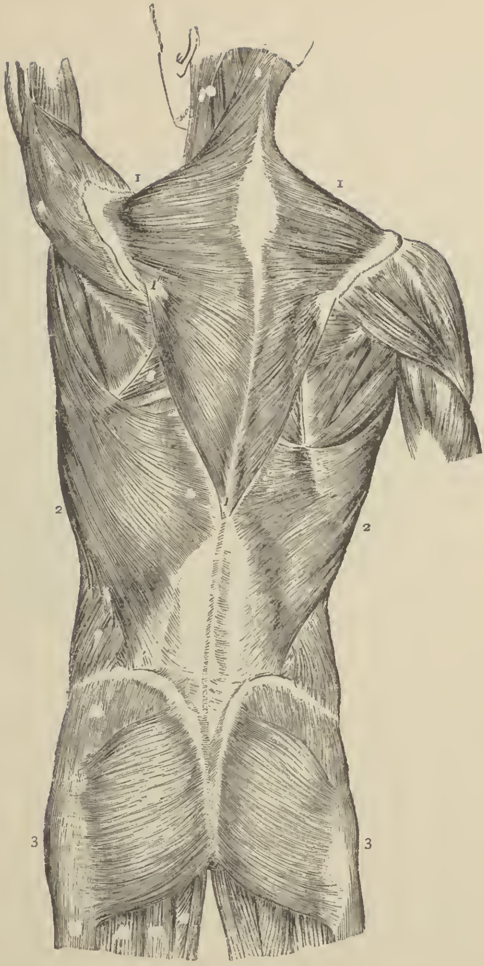
FLEXOR AND EXTENSOR MUSCLES OF THE LEG.

relaxation of these two sets of muscles that the movements of the body are accomplished. So that in order to perform their work, which is that

of contraction, the muscles must exert enough force to elongate the opposing muscles, must overcome forces exerted by the tonicity of the antagonizing muscles, and must lift the weight of the portion of the limb into which they are inserted. It is by the action of the muscles that the body is held upright.

The trunk is maintained from falling backward by the action of those huge muscles on its anterior surface. The space between the pelvis and the thorax is called the abdominal cavity. Its walls are almost wholly composed of muscles. There are several important facts to note about these muscles. First, that they extend from the brim of the pelvis, into which they are inserted, to the ribs and breast-bone, to which the other ends of these muscles are attached; that there are three layers of these muscles; and lastly, that the fibers of these different layers run in different directions so that they cross each other as shown on p. 58. The re-enforcement of the layers, the arrangement of their fibers, and the manner in which they dovetail into the adjacent groups of fibers, give a structure of the greatest possible strength.

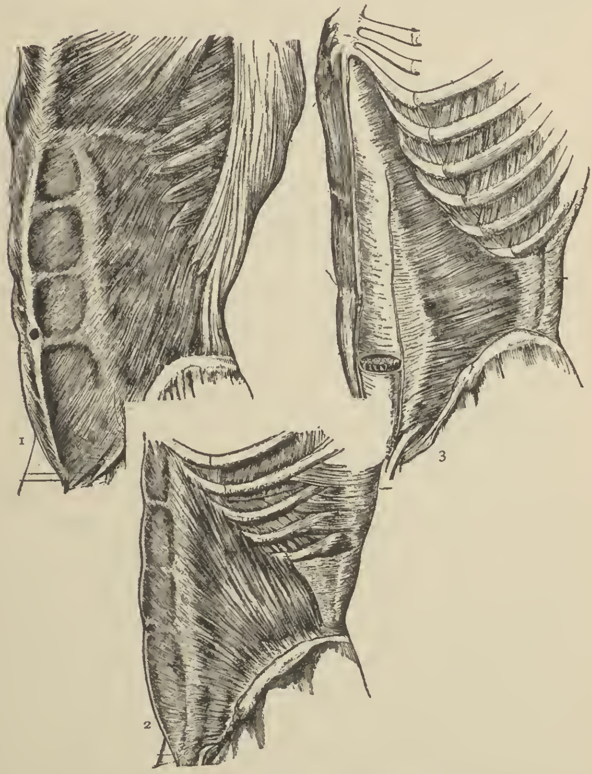
The trunk is kept from falling forward by the action of the muscles of the back. These are



MUSCLES OF THE BACK.

1. Trapezius muscle. 2. Latissimus dorsi. 3. Gluteal muscle. 4. Rhomboid muscles are in second layer under trapezius and cannot be seen.

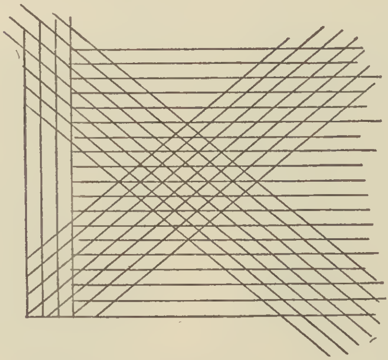
divided into six layers. The cut shows the direction of the fibers. Take the first or outside



1, 2, 3. THE THREE LAYERS OF ABDOMINAL MUSCLES.

layer, which consists of the trapezius and latissimus dorsi, or, in other words, the broad muscle

of the back. You see on the one side these muscles are attached to the spines of the vertebræ, the sharp ridge which you feel in the middle



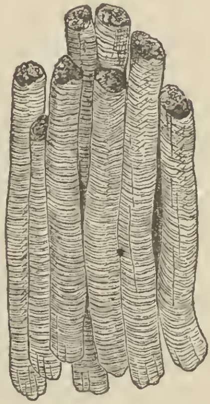
DIFFERENT DIRECTIONS OF FIBERS IN THE THREE LAYERS OF ABDOMINAL MUSCLES.

of the back, and the broad attachment to the pelvis affords a firm basis of support. There are other muscles which run parallel with the spinal column, whose function it is to hold the spinal column erect.

Standing erect calls into action almost all the muscles of the lower extremity, trunk, and neck. So long as the line of gravity falls within the area of the feet, the muscular effort required is so slight that it is little more than the tonicity contained in all living muscle. The greater the displacement of the line of gravity, the greater

the muscular effort required to maintain the equilibrium of the body.

The muscles of the body, even when at rest, are under a slight degree of tension. When stimulated, the muscle contracts, that is, it becomes shorter and thicker. A muscle can only remain in a state of contraction for a few seconds, because the force of the muscular fibers is more or less exhausted during contraction. The more rapid the contractions the sooner does fatigue manifest itself. Like the steam engine, the muscles of the body in performing their work produce heat and motion. The fuel which supplies this force is taken into the body as food, it is prepared for use in the intestinal tract, and from there carried by the blood to be stored up in the muscles and various tissues as latent force. The muscles contain one-fourth of all the blood in the body. The blood is also a carrier of oxygen, which it receives in the lungs. Now, as in the



MUSCULAR FIBERS, HIGHLY MAGNIFIED.

grate we have carbon in the form of coal and it is surrounded by oxygen from the air of the room, the oxygen and carbon do not unite until ignited by the flame of the match. The same thing happens in the body, where the ignition is caused by the stimulus of the will.

By watching a muscle when contracted, we learn that there is not only a change of shape, but a dilatation of its blood-vessels, that is, more blood passes through a muscle when it is contracting than when it is at rest, and this increased flow continues for some little time after the contraction has ceased; there is also a rise of temperature. Nearly three-fourths of the heat developed is produced in the muscles at the actual moment of muscular contraction. Hence we learn that the whole body is heated by muscular exercise; the even temperature of the various parts is maintained through the circulation of the blood. This combustion, going on throughout the entire economy, is the source of all the force or energy of the body. In every movement, every breath taken, in the change even of a muscle of expression or the conception of a passing fancy, combustion has occurred and potential force has been liberated.

The fatigue produced by contraction may be due to the consumption of the readily available material present in the muscle, to the consumption of the supply of oxygen, or to the presence of the products of combustion. During repose, either the internal changes of the tissue manufacture new explosive material out of the comparatively raw material already present in the fiber, or the directly hurtful products of the act of combustion undergo changes by which they are converted into comparatively inert bodies. A stream of fresh blood may exert its restorative influence, not only by quickening both these events, but also by carrying off the immediate waste products, while at the same time it brings new raw material.

Every movement of the body depends as much upon the proper co-ordination of the muscles for its accuracy, grace, and force as upon the strength of their contraction. And while the fatigue of which we are conscious in our own bodies after prolonged or unusual exertion arises partly from the exhaustion of the motor nerves, it is chiefly from the exhaustion of the central nervous system concerned in the production of voluntary impulses. A man who says he is absolutely

exhausted may, under excitement, perform a very large amount of work with his already wearied muscles. The will rarely, if ever, calls forth the greatest contraction of which the muscle is capable. Absolute temporary exhaustion of the muscles of the body, so that the strongest stimuli produce no contraction, may be produced by artificial stimulation; recovery takes place on rest. In exhausted muscle the elasticity is much diminished; the tired muscle returns much less readily to its natural length than does the fresh one.

Up to a certain extent, exercising the muscle develops the strength and size of the muscle—hence the powerful arm of the blacksmith and leg of the danseuse. This fact is made use of by actors who wish to give to their faces the expression of the character which they represent.

There are twenty-eight muscles about the mouth, and the habitual expression of the face will develop just those groups of muscles which cause this expression, whether laughing, crying, pouting, sadness, joy, etc.

All those muscles which form the great bulk of the body and face are under the control of the will, and are called voluntary muscles. There are

MUSCLES OF THE HEAD, FACE, AND NECK.

other muscles found within the body over which the will has no control, and these are called involuntary. They preside over those functions which are essential to life, and a cessation of which would result in death. Such is the heart, which is only a powerful muscle that pumps the blood through the body. Involuntary muscle is also found throughout the digestive tract, in the uterus, bladder, walls of the blood-vessels, etc.

When a muscle within the body is unused it wastes; when used within certain limits, it grows. Both these facts show that the nutrition of a muscle is favored by its functional activity. To this should be added another physiological fact, that for every muscle there is a certain weight of load by which the most work will be done, and of two muscles of equal length, the greatest amount of work will be done by the one which has the greatest sectional area.

In physical culture the object aimed at is the symmetrical development of all the muscles of the body. Hence the necessity for bringing every individual muscle into play, both for its development and later for its maintenance. The necessity for an alternation of work and rest has been hinted at.

Professor Parkes has concluded that a healthy adult should bear without the risk of over-fatigue what would be equivalent to a walk of nine miles, from which must be deducted the exertion used in ordinary business pursuits.

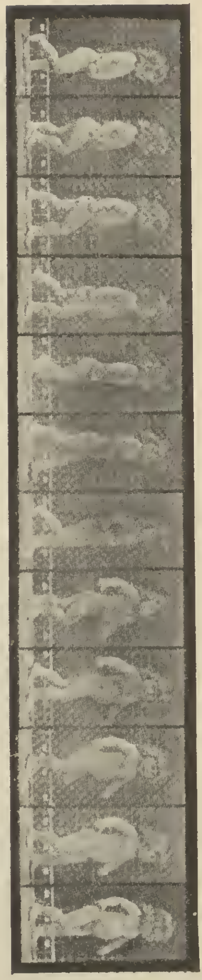
Outdoor Exercise.—The tendency of almost all forms of exercise is to develop some portion of the body at the expense of the rest. No system of physical education is complete that does not aim at the symmetrical development of the whole body.

The most perfect form of exercise is, then, that one that will most nearly call into play all the muscles of the body. All exercises may therefore be divided into three classes: Class I includes climbing, swimming, sparring, fencing, rowing, and bicycling. Class II includes those exercises that call into action chiefly the muscles of the upper and lower extremities—foot ball, shooting, tennis, rackets, lacrosse, and cricket. Class III includes those exercises that call into action chiefly the muscles of the lower extremities—walking, running, riding, dancing, and leaping.

Beginning with the third class, which are also only third-rate exercises, since we see that both the other classes call into action a greater

FACIAL EXPRESSION.

number of muscles, we find that of all these, walking is the only form of exercise which may be said to be universal. In walking the muscles of the chest get little exercise and those of the spine and abdomen even less. In slow walking there is a period when both feet are on the ground together, while in fast walking one foot leaves the ground the moment the other touches it. The length of the step should depend on the length of the leg; this may be increased or diminished by direct muscular effort.


WALKING CHILD.

In walking, the arms should swing easily at the sides, both from a physiological and æsthetic

point of view. Compare the grace of the attitude of the walking child with that of the city woman. Carrying the hands in a muff or clasped in front is an unphysiological habit, to which is due that peculiar waddling which many women exhibit when moving rapidly. In addition to spoiling the gait, it contracts the chest. The woman who depends on walking for her outdoor exercise should walk at least three miles every day, and walk at the rate of three miles an hour. To the woman who is weak or unaccustomed to any exercise, the guide for the amount of exercise taken at one time must be, at the first sense of fatigue *stop at once* and rest, and then you will be able to continue and complete the required amount with enjoyment and return home with a feeling of *bien-être*, instead of exhaustion.

After acquiring as great a walking speed as is consistent with a graceful and easy carriage, begin the running exercise, gradually increasing the distance but not the rate of speed.

In exercising, all tight clothing about the neck, chest, and waist must be removed. Pure air and full breathing are required during and after exercise ; the latter not only promotes the change of air in the lungs, but also quickens the functions

CITY WOMAN IN WALKING COSTUME.

of the circulation and digestion. Eating must be avoided shortly before or shortly after any considerable exercise, as digestion is thereby impaired.

Running is the best exercise for developing the breathing capacity. In slow walking we saw that both feet were on the ground momentarily together. In running just the reverse is true, that is, both feet are off the ground at the same time. To prevent the body from falling, a quick short leap or kind of jerk is given to the body by quickly flexing the active leg at the commencement of the step and forcibly extending it. The duration of the pressure of the feet upon the ground is less than in walking, this being in proportion to the energy of the gait. The gait depends upon the extent of each fall, rather than upon the number of falls. While brisk walking is allowable, fast running is not. In running always begin slowly, running moderately for perhaps fifty feet, then increase the speed gradually, but in running for exercise *never* speed to the utmost, as this is not necessary for the benefits of the exercise. A five-mile gait is quite sufficient, and a healthy person in good form ought to cover two or three miles easily and

without experiencing at any time any marked shortness of breath or sense of exhaustion. Always close the run with the same moderation with which it was begun, that is, never stop short, as this sudden arrest of action gives a most undesirable shock to the heart.

Gentle running is generally advised as a constitutional exercise for all those who can take it. This is usually severe enough to start the perspiration and make a bath of some kind desirable. A tepid sponge or shower bath is usually advised. This must be followed by a vigorous friction and a rest before the principal meal of the day. Since after exercise the temperature falls one degree, exposure to cold must be guarded against, as this is especially injurious to the heart.

When anyone who is tired, overworked, or who has been leading a sedentary life, engages in active exercise which makes the greatest demand on the heart and lungs, as boating or running, instead of a beneficial result accruing, serious and often permanent injury frequently follows. The intensity and duration of the movements practiced must be increased very gradually, if increase of muscular strength is desired. As soon as

RUNNING CHILD.

fatigue is appreciable exercise should be suspended and rest should continue until this feeling is gone. Rapid respiration, palpitation, dizziness, headache, the face becoming pale or pinched, or flushing suddenly, a feeling of great heat or excessive perspiration, are all danger signals, showing that exercise has already been carried too far, and should cease at once. Continued overexertion carried to a point of exhaustion leads to an obstinate irritability of the heart as well as to organic lesions.

Dancing might form a very healthful exercise, were it done in the open air and with other favorable circumstances. As it is, the dance takes place in an overcrowded, ill-ventilated room, the woman is not properly dressed to take any exercise at all, and it is carried to excess. Hence women are carried out of the ballroom in a fainting condition, and, occasionally, someone drops dead. This subject will be referred to again.

Skating is another delightful outdoor exercise, developing chiefly the lower extremities. But owing to the clear bracing air and the amount of enjoyment it affords, it should take a high rank among outdoor exercises.

Climbing, whether mountains or trees, brings

into play almost every muscle of the body. Boerhaave, the famous physician, declared that a man was more likely to get well by climbing a tree than by drinking a decoction made of its leaves!

All the foregoing have the advantage of requiring no apparatus or outlay of money, that they may be so varied that much pleasure will be derived from them, and they are equally available for town, city, or country.

Rowing is one of the exercises which call into action almost all the muscles of the body. When the handles of the oar are grasped, there is a contraction of the abdominal muscles, the trunk is flexed on the thighs at an angle of 45°, and the arms are fully extended. The oar is now lowered into the water and the boat is propelled forward by the retraction of the scapulæ or shoulders, by the trapezius, latissimus dorsi, and rhomboidei muscles (for which see plate p. 55) and the entire trunk is drawn backward to the upright position by the action of the powerful glutei muscles. The movements of flexion and extension call into play all the muscles of the arms and legs, the "stretcher" acting as a brace for the feet. The action both of the heart and lungs is

ROWING.

greatly accelerated. In short, the fact that it calls into action more muscles than are engaged in almost any other form of athletic exercise, is

WOMAN IN RIDING COSTUME.

practiced under the most hygienic surroundings, and with a degree of pleasurable excitement that adds materially to its sanitary value, should make it form one of the outdoor exercises of every girl and woman to whom the water is accessible.

Horse-back riding, as now practiced by women, is an exercise of questionable value. The side saddle often increases the tendency to lateral curvatures of the spine, while the tight corset prevents the good that would otherwise accrue to heart, lungs, and the digestive organs.

Bicycling.—The newest exercise, one which is at present attracting the most attention, and last but not least, the exercise which it is said will accomplish for women that which the centuries and the combined wisdom of the medical faculty have failed to do, namely, a reform in her dress, and insure her taking a sufficient amount of exercise, is bicycling.

Observation teaches that very few people, especially women over twenty-five years of age, will take any form of exercise systematically for any continued length of time unless it is combined with pleasure. While learning to balance one's self on the wheel and to steer it are comparatively easy, to sit erect, to ride gracefully and easily are sufficiently difficult to stimulate the ambition, to arouse dormant energies, to require the entire concentration of the mind and will power, which most happily brings the rider outside of herself and the troubles of her daily life.

After all this has been accomplished she still has left to her the pleasure that must always come from doing anything well; the exhilaration that is caused by rapid motion; the ease and rapidity with which she covers the ground brings her into new scenes, which can be varied from day to day; finally, it is an outdoor exercise that can be enjoyed with congenial spirits. It will be seen at once that the effect upon the mind in the mentally overworked and the bodily under-exercised, as well as in those cases where physical weakness has caused a depression of spirits verging on melancholia, is quite ideal.

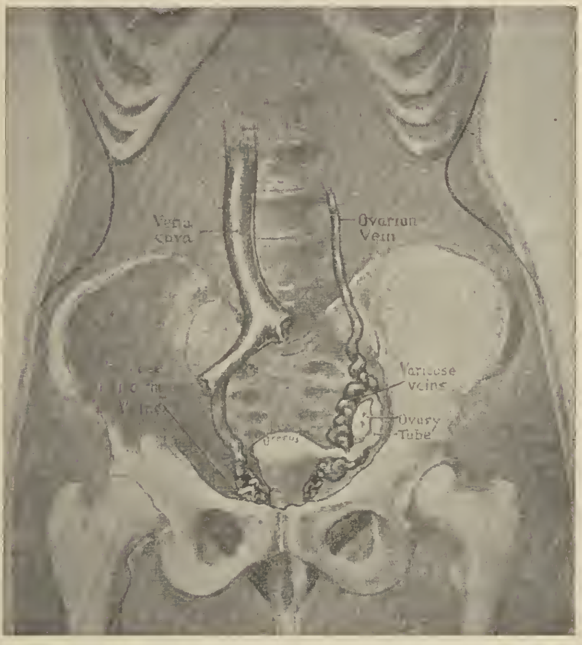
Now, merely considered as an exercise *per se*, we have seen that that was the most ideal form of exercise which symmetrically developed the greatest number of muscles and organs of the body. It is claimed for bicycling that the muscular system is as a rule uniformly well-developed, and that the legs are not developed at the expense of the other muscles of the body. To sit erect and balance one's self on the wheel brings into play continuously all the muscles of the back, neck, and sides of the trunk. Steering, riding rapidly, and hill-climbing exercise vigorously the muscles of the arms and shoulders.

The abdominal muscular movements are sufficient to cause a shrinking and reabsorption of superfluous abdominal fat, and at the same time tend to overcome obstinate constipation; while the increased frequency and depth of the respirations bring into play the muscles of the chest and the diaphragm. Like the other muscles of the body the heart is also increased in its size and tone. That is, the heart, being larger and more vigorous, is enabled to contract more powerfully, and by pumping the blood more forcibly through the system, and at the same time because of the increased chest capacity, the suction power is increased by which it draws the blood back to itself. For, in addition to the increased power of the heart there is an increased capacity of the lungs.

From a table of fourteen amateurs who have ridden a great deal for a number of years, Dr. Hammond found,* first, that they had acquired simple cardiac hypertrophy without dilatation, and second, that their breathing capacity was greatly in excess of that of the average man. The cardiac hypertrophy referred to is due simply to an

* The Influence of the Bicycle in Health and in Disease, by Graeme M. Hammond, M. D.

increase of muscular tissue and is in the nature of a healthy growth or development induced by



THE VALVELESS VEINS,

With the varicose conditions that may ensue from strain during waist constriction.

exercise, precisely the same which occurs in any other muscle which has been used a great deal. " Taken into consideration what a great influence is exerted on the general health and on the

proper performance of the functions of the various organs by a perfect oxygenation of the blood, and when this is added to the action of a powerful muscular heart, it can readily be seen that bicycle riding, if conducted properly and for a long time, induces a condition of cardiac and pulmonic development which must exert an enormous influence in maintaining the proper functions of other organs, and in overcoming disease that has been contracted."

The relief that is afforded to the congested condition of the pelvic vessels and pelvic organs is particularly marked and fortunate. Pelvic congestion is relieved by the improvement of the general circulation that will be caused by any general exercise systematically pursued. But in addition to this it is claimed that since in riding the wheel the leg muscles do most of the work, the pelvis will be subjected to a much greater rapidity of circulation, the pelvic vessels, pelvic muscles, and the pelvic floor with the organs above it, all receive a well-defined stimulus, and by degrees a permanently increased tone, from regulated riding. And indeed gynecologists are pretty well agreed that this will afford relief in many cases of pelvic congestion, which these

patients will never find in taking "rest cures" at the sanitariums. Only be it remembered that during the menstrual period there is normally a physiological congestion of these organs; and during the first two days of this time women should never mount the wheel, or at least only for short distances.

The question is often asked why physicians recommend the use of the bicycle to their patients at the same time that they forbid the use of the sewing-machine. The bicycle takes the woman out of doors into the fresh air, it is entirely under her control, so that the exercise can be made as gentle or as vigorous as she desires, and most women dress suitably for this exercise. At the sewing-machine the muscles of the inner side of the thigh and the abdomen are used principally, and the woman treadles more rapidly than the wheelwoman, not giving these groups sufficient time to rest, at the same time the feet rise on an incline, instead of the straight up and down motion of cycling. In addition, the stooped and constrained position of the trunk, and the sharp concentration of the eyes on the work to guide it in a straight line under the needle form a prolific source of headache due to the eye-

strain. From the stooped position comes the contracted chest with an aching of the muscles of the back and neck. Further, the sewing-machine operator avers that she is obliged to wear a corset to hold her up. As she leans forward the outward pressure made against the upper end of the corset-steels throws in the lower end and presses the pelvic contents inward at the same time that the contracted waist forces the abdominal contents downward. And this increases the pelvic congestion by interfering with the return of the venous blood to the heart. Machine running simulates more the *faulty* way of wheeling, and the position is almost identical with that assumed when handle-bar and saddle are placed too low. In wheeling there is greater variety of movement and less tension of the muscles.

On fairly level roads there is far less exertion than in walking, while the rate of speed is thrice as great. The quicker movements of the legs causes the blood to circulate more rapidly through the system, as well as to greatly increase the quantity of oxygen inhaled. Through the perspiration which is induced many impurities are thrown off through the pòres of the skin. There is also increased elimination of morbid materials

through the increased activity of the kidneys, and a great improvement in the digestion and assimilation.

In the light of experience it is believed that for healthy individuals bicycle riding is one of the most excellent forms of exercise for maintaining health, retarding disease, and strengthening the constitution; and in many forms of disease, when used cautiously and under medical supervision, it will often be found an inestimable advantage.

The diseases in which it is particularly recommended are cases of nervous prostration, weak ankles, functional paralysis, rheumatism, and gout. While it is contra-indicated in certain forms of heart, lung, and kidney diseases.

Not only in those cases where a woman knows that she has a weak heart, diseased lungs, or some well-marked pelvic disorders, should she consult a physician before learning to ride, but in every case where the general health is noticeably below the normal.

The choice of a wheel is a matter of importance. A heavy woman would be liable to break a wheel which is too light for her; on the other hand, too heavy a wheel is an unnecessary burden, especially to a woman who is not strong.

The rules for dress are very much the same as for taking any vigorous exercise. The clothing should be all wool, and as light as is compatible with warmth. The corset must be discarded, as well as all tight bands and tight shoes. The knees must have perfect freedom in pedaling. Lining the skirt with silk will do away with considerable friction between the skirt and bloomers.

Like other vigorous exercises, bicycling should not be undertaken within two hours after meals, especially dinner, and should cease one hour before meals, so as not to interfere with digestion.

Beginners should not ride more than a mile or two, gradually increasing the distance as it is found it can be done without fatigue. Women who are weak or not accustomed to taking much exercise, must be particularly careful to stop riding at the first sense of fatigue. The tired feeling should wear off after a short rest. No exact rules can be given as to the length of time or the distance to ride. When the rider cannot breathe easily through the nose and with the mouth shut, it is time to stop.

Hills should be taken quietly. If you are not

strong, it is better to walk most of the hills. The change of exercise and rest out of the saddle is beneficial as well as enjoyable. When you find you can do so without fatigue, take long rides at a moderate speed, and vary your routes as much as possible.

Excessive and exhaustive exercise does no good, but actual harm to the system, and may produce languor, irritability of the disposition; and what is much worse, riding excessive distances or at a great speed may actually produce heart disease.

It is said that more evil comes from bicycling than from any other exercise, due to the improper attitude and overstrain. The tendency is to overtax the heart.

A stooped position in riding causes curvature of the spine, round shoulders, contracts the chest, and healthy development is arrested; at the same time dilatation of the heart, impoverishment of the blood, and lowered vitality of the system are probable consequences.

For a good style of riding the saddle should be so adjusted that, when sitting upright with the limbs extended, the toe just touches the lower pedal comfortably, and when propelling, the ball

of the foot and not the instep should rest upon the pedal. Riding with the saddle too low impedes the action of the muscles of the leg; and there is a constant tension of the muscles above the knee, and as a result they become cramped. The saddle should be amply high for the entire leg to be fully extended, and give to these muscles a second of relaxation on the downward stroke of the pedal.

Knee and ankle movement should be adopted from the first, the two working conjointly together with the thigh do the bulk of the work. Take care to pedal evenly; don't favor one leg more than the other. The pedals should be so placed that no abduction of the thighs is necessary, or the feet will be too widely separated for graceful riding. The handle-bars should be of such a height that the handles can be easily grasped with the fore-arm extended and the body erect. The handle-bars when placed too low cause a forward stoop which interferes with chest expansion.

Sit with the trunk erect, the chin up and well away from the body, and the weight of the body resting on the gluteal muscles, not on the perineum. With the weight resting well against

the back of the saddle, push thence with the hips, not the body, which should remain still and erect, in an easy and graceful position. Be careful to avoid any movement of the shoulders or wriggling in the seat, which looks bad and is usually the cause of the breaking of the saddle-springs.

When overheated, do not remain still in the open air or in a cool room without an extra wrap; otherwise there will assuredly result a chill of the surface, with a congestion of the internal organs. In the popular vernacular, you will catch cold.

To obtain the best results you should, after cycling, go directly to your dressing room, and be immediately rubbed with soft towels until thoroughly dry. After this a further rubbing with alcohol will prevent you from becoming stiff. Rubbing by the bare hand of a healthy person is one of the most useful adjuncts. By it the muscles are made firm and pliable and the skin is kept in a good, healthy condition. No amount of rubbing with towels is as refreshing as rubbing with the bare hands. One should never allow herself to become overheated in riding unless she can be properly rubbed down after-

ward. After this rest in the horizontal position from half an hour to one hour.

To do any good the riding must be done in a regular and systematic manner.

Of all outdoor exercises for women, swimming is one of the most perfect. It not only calls into vigorous action most of the muscles of the body, but spares many of those muscles which are so commonly overworked, the most of the work being performed by muscles which are so little used as to have become flabby and weak. For instance, the extensors of the fingers and hand, that are so constantly stretched in sewing and writing, are in constant use in swimming, while the corresponding flexors, the slaves of the needle and the pen, are relaxed. Again, those muscles passing from the shoulder-blades to the trunk, on which depend much of the erect carriage and strength of the chest, which have become wasted from disuse while the woman has bent over the needle, sewing-machine, or desk, are the very muscles by which the movements of the upper half of the body are executed. While all the muscles of the lower extremity are brought into use, of especial value is the free movement at the hip joint, a joint that is seldom moved

with any degree of freedom from the time a girl leaves off climbing trees unless she has the advantage of special gymnastic training. The vigorous action demanded of the inspiratory muscles greatly increases the chest capacity.

The body is lighter than the water and is perfectly supported by it, so the weight is taken off the spine, and the muscles of the back are relieved from their normal state of tension. The head is the only part of the body that is held up by muscular action, and in floating even this is supported by the water.

The disadvantages arise from the fact that a prolonged stay in cool or cold water produces in most persons a liability to cramp. During the month of August the temperature of the ocean reaches its maximum of 66.65° Fahrenheit. This is about 32° Fahrenheit below the temperature of the body. Upon entering the water the first effect noticed is a sensation of cold; this varies with the susceptibility of the individual and the difference between the temperature of the water and the surrounding air. The skin assumes the appearance of "goose-flesh," the face is pale and anxious, the lips blue, the pulse decreases in frequency, a sense of

oppression is manifest, and there may be a spasmodic shivering. That is, the first effects of the immersion is to cause a contraction of the blood-vessels of the surface of the body. This should be quickly followed by a secondary reaction, in which there is a sensation of warmth, a quickened pulse, and an increase of energy. When by taking the proper precautions this reaction does not take place it is a contra-indication to bathing.

If the immersion in the water has been too prolonged there is a second sensation of chilliness, a signal that the bathei must leave the water at once.

The best time for bathing is between eleven and four o'clock, depending on the tide. No one should go into the water within two hours after meals, nor should she, on leaving the bath, proceed to the table, since digestion draws the blood from the periphery to the stomach, and to eat immediately after the bath is to lose most of the benefit of the saline treatment.

All should avoid bathing in anything but hot water when fatigued, and swimmers ought to pay especial attention to this point on account of the demand they are going to make on their muscu-

lar systems. And on no account must one enter the water when in a perspiration ; let her first take a moderate walk along the shore until the perspiration has subsided. These injunctions are of the highest importance, unless one would emulate the rashness of Alexander the Great, and suffer the same fate, by plunging an overheated body into the water.

Enter the water quickly until the water reaches the waist, then plunge headlong, or cover the body to the neck. Care should be taken to wet the chest and abdomen immediately, since these are the parts most sensitive to the impression of cold. Everyone should learn to swim ; and those who will not must move the arms and legs about vigorously. The duration of the bath should depend on the health and strength of the individual, on the state of the weather, and on whether the water be rough or calm. The average duration of time spent in the water should be from three to fifteen minutes, the latter being the maximum time for anyone. No benefit will accrue from spending a longer time than this in the water, and much harm may result.

The sea-bath should be followed by moderate exercise to insure a perfect reaction and to aid in

expending the superfluous energy which sea-water imparts.

Swimming and sea-bathing must be avoided by persons who have a weak circulation and in whom the reaction after a plunge into cold water is never established. Also by persons with heart or kidney diseases and aged persons.

Persons with feeble constitution, but with no actual disease, as in hysteria, insomnia, and some forms of nervous prostration, generally derive marked benefit from sea-bathing.

People who are weak should walk and not plunge into the water. As in all other exercises, a determination on the part of the weak to equal the strong is a fertile source of mischief.

The principal outdoor games are croquet, archery, tennis, cricket, football, and baseball. Of these croquet is the mildest, and for that reason is a good beginning exercise for a woman who has always led a sedentary life. To be beneficial and not detrimental, the exercise must be very gradually increased both in the length of time occupied and the vigor of the movements. The muscles must be slowly built up and improved in tone, the lungs enlarged and probably new air cells formed, while the heart must

be educated to contract rapidly and the blood-vessels to carry an unusually large volume of blood.

Tennis is a much more violent exercise, and one which is often carried to excess. It should not be undertaken until the system has been somewhat developed through the milder exercises. Croquet, archery, and tennis are all alike defective in that one arm only is required, hence developing the muscles of the right side of the body alone.

As the great majority of these outdoor exercises can only be indulged in for seven months of the year, they should be supplemented by exercises in the gymnasium for the remaining five winter months. At a very early period the Greeks had recognized the truth that with the advance of civilization and civilized modes of life, a regular system of bodily training must be substituted for the lost opportunities of physical exercise which Nature affords so abundantly to her children in the daily functions of their wild life. The laws of Lycurgus provided free training schools for the physical education of both sexes. In one's life will always come moments when the woe and weal of years depend on strong

nerves and a strong hand, and such moments prove the value of a system of training which teaches children to treat danger as a mechanical problem. Lycurgus not only laid down laws which for five hundred years made Sparta the chief city of Greece, but he was able to outrun all the mob who persecuted him and forced him to seek refuge in a sanctuary.

One should always have the greatest variety possible in the kinds of exercise taken, not only to develop the body symmetrically, so as to obtain strength, vigor, grace, celerity, and accuracy of movement, but also because there is no such potent cause of fatigue as monotonous repetition of the same act, whether physical or mental.

Do not expect a too prompt return from any system of exercise. Physical growth is almost as slow as mental development. Do not expect to counteract in a few minutes those influences which are at work from morning until night, or to overcome in a moment physical defects which have existed for years, and perhaps from infancy. But the beneficial results of such training, and the amount of development which may be attained, are as capable of demonstration as any mathematical problem, and no one need fail to secure

results proportionate to the amount of labor expended.

The direct effect of exercise is seen in the increased frequency and force of the heart's action and dilatation of the arteries, as well as in increased respiratory action. In extreme exertion the heart may be embarrassed by the act of breathing. This will be better understood when we come to study the mechanics of the circulation. The facts in the case are as follows: at the end of deep inspiration, the increased pressure of the lungs impedes the flow of blood from the right heart to the lungs, the right heart becomes overfull and the blood is dammed back in the veins. At the same time general muscular contraction presses on the arteries, passing through them, and causes an increased arterial tension which may lead to enlargement of the left side of the heart. The interchange of carbonic acid for oxygen does not take place with sufficient rapidity, and the blood becomes surcharged with carbonic acid. When exercise is regularly taken the arteries accommodate themselves to the strong action of the heart, and there is a general improvement in the breathing power.

Active exercise tends to equalize the circula-

tion, and by causing a dilatation of the surface capillaries lowers the temperature and increases the activity of the excretory glands. Thus the amount of work thrown on the kidneys is lessened and the skin is rendered clear.

During its early stages, digestion is retarded by exercise, since it prevents the necessary flow of blood to the stomach, but during its later stages it is aided by the vigorous abdominal circulation.

Another benefit resulting from exercise is seen in the bones, since muscles are the most powerful agents in giving shape to the bony framework to which they are attached, and in accelerating its growth and development. So that from the inactivity of a muscle not only does it become weak, flabby, and waste away, but the nutrition of the bones to which it is attached will become impaired. And as the natural result of the sedentary occupations of woman, and the lack of active exercises for the muscles of the back, we find that one of the most common deformities is a backward curvature of the spine. It is recognized by the drooping of the head, the forward inclination of the shoulders, with the wing-like projections of the shoulder-blades—a deformity that is almost wholly confined to civilized nations.

But the most beneficial result is seen upon the nervous system. It has been supposed that excessive exercise renders the intellect less active, owing to the greater expenditure of nervous force in that direction; on the contrary, it has been proven that sufficient exercise is necessary for the perfect performance of mental work. Du Bois-Reymond demonstrated that the most marked influence of physical exercise is upon the nerve centers. In every bodily movement of a composite nature, the gray centers of the brain and cord are at work equally in securing the result, and are exercised at the same time. Every time a child co-ordinates a well directed movement, the movement exercises and develops its brain, and the movement of the muscles is as necessary to the mental development as the health and integrity of the brain are to the physical development of its parts. The muscles and brain are developed by reciprocal action, and in later life a direct relation is found to exist between great physical strength and the possession of those intellectual qualities which naturally lead to commanding positions of authority; while from statistics from Oxford and Cambridge it appears that the rowing men and cricketers have

obtained more than their proportional share of academic honors.

Vigorous muscular exercise, especially when pushed to the point of fatigue, demands a vigorous action of the *will;* a consciousness of increased power is thus acquired, and this in turn begets self-confidence, resolution, and courage; qualities which, if rightly directed by proper moral and intellectual training, elevate the tone of the entire character, and aid in an important degree in subduing the passions. That the mind possesses a more perfect control over a vigorous than over a morbidly sensitive body has given rise to Rousseau's paradox: "The weaker the body, the more it commands; the stronger it is, the more it obeys."

It has been repeatedly proven that physical deterioration can be overcome by exercise, and that by so doing the mental capacity is greatly increased. Cæsar was naturally of a delicate constitution, suffering from severe headaches, and was probably epileptic, but by continual exercise became an athlete, "admirable in all manly sports," and surpassed by none in enduring the fatigue and hardships of a military life.

"Ye gods, it doth amaze me,
A man of such a feeble temper† should
So get the start of the majestic world,
And bear the palm alone."
—*Cæsar*, Act i. Sc. 2.

Cicero is described by Plutarch as at one time thin, weak, and dyspeptic, but as having been so strengthened by gymnastic exercises at Athens as to become robust and vigorous. While Pliny tells us that Asclepiades, who lived in the second century before Christ, cured all diseases by physical exercises alone, and said he was willing to forfeit all claims to the title of physician should he ever fall ill or die except from accident or senility. He lived for more than a century, and died as the result of an accident. Themistocles, Socrates, and Plato all excelled in gymnastic exercises.

As the result of his own experience and observation as to the benefits obtained by women through outdoor exercise and gymnastics, Dio Lewis says that during the three summers that he camped out in the mountains of California a number of ladies joined the party. They all adopted the rough, short mountain dress, and rode astride. From being delicate invalids seek-

† Temper here used for temperament, constitutional quality.

ing health, several of them became the most adventurous and enduring members of the party. One-half of the 421 graduates in the Boston school for physical education were women, many of whom had been teachers broken down in health. The result of the removal of the corset and the long heavy skirts, together with the use of those exercises which a short and a very loose dress renders easy, was that in every one of the ten classes of graduates the best gymnast was a woman. In each class there were two to six women superior to all the men.

During his personal supervision of the Lexington School for Young Ladies, there were nearly three hundred pupils with an average age of seventeen years. The object was by a new regimen to improve their bodies during their school life, as is the custom for men in some of the German universities. Many of the girls came from private families and were so delicate as to be unable to bear the artificial life of private seminaries. The constant dress of the girls, like that of the normal school, was short and loose, leaving them as much liberty as the boys have in their gymnastic dresses. On entering the school all the measurements were taken; in eight

months there was an average gain about the waist of 5 inches, chest, 2½ inches, arm, 1½ inch, and fore-arm 1 inch.

"Little or no attention was given to periodicity. The girls worked through the entire month in those extreme stridings and other vigorous exercises of the legs and hips contrived to counteract the evil effects of the long imprisoning skirts, and in the four years not only was no harm done by this constant and dreadful violation of Dr. Edward Clarke's counsels, but in no instance did a pupil fail to improve in health. From the semi-invalid condition in which they entered the school, in a few months they could do the full and hard gymnastic work of the school, dance three evenings of the week, and walk five to ten miles on Saturday without inconvenience."

Dr. Mary Taylor Bissell, the medical director of the New York Berkeley Ladies' Athletic Club, gives as the result of her experience there: "The gains of twelve months' exercise in the gymnasium are, for the chest two inches, stature two inches, an increase of thirty per cent. in the lung capacity; many of the strength tests are doubled, the spine is erect, the arm vigorous, and the girl

has gained for herself the consciousness of controlling her own body, instead of having it control her."

From the measurements of twelve hundred boys and girls Professor Sargent ascertained that at the age of fifteen years boys are three-quarters of an inch taller than girls, but the mean height in the two sexes is the same, and that taking the sum of the measurements of the head, chest, waist, legs, and arms, the mean total was equal in boys and girls. The sum of these measurements is regarded as indicative of the strength of the individual. But as a matter of fact it was found that girls did not compare favorably with boys in the point of strength. In capacity of lungs the girls were seventy cubic inches behind the boys, and in strength of the expiratory muscles the weakest boy was stronger than the average girl. In strength of back, leg, chest, and arms the showing for girls was a little better, though considerably below what it should have been.

At twenty years of age the man was found to be five inches taller and twenty pounds heavier. The superiority of the male in strength was now much more apparent than at an earlier age. He now presented ninety cubic inches greater

lung capacity and 143 pounds greater strength of legs, while the muscular power of the arms and chest was more than double that of woman. The charts showed that women were physically inferior to men in almost every particular.

Dr. Sargent then goes on to say that "the principal characteristics of general form that distinguish civilized women from men are smaller muscles, sloping shoulders, broader hips, and shorter legs. The smaller muscles and shorter legs may be said to be embryonic, while the superior breadth of the hips indicate a greater evolutionary advancement in this part of the body than has taken place in men. The constricted waist must be regarded as a deformity artificially produced. When the hips are large in the male or female the waist will be naturally large if the muscles which connect the trunk with the pelvis have nothing to constrict them. Since the hips of women are much wider than those of men, we should expect to find the waist proportionately larger in women than in men.

"From an anatomical point of view the tissues of a woman do not differ materially from those of a man. The bones, muscles, arteries, and nerves are similarly constituted, and are governed by the

same laws in their development. So also the heart, lungs, stomach, and brain. Anything that will impair the function of an organ in one sex will certainly interfere with its action in the other. If you put a tight bandage around the waist of a man, the physiological functions of the abdominal and thoracic organs are for the time impaired, and the man is unable to make more than two-thirds of the mental and physical exertion of which he is capable.

"Put a restriction around the waist of a boy or girl so that the arms cannot be raised above the head, or issue an edict that the legs shall not be raised above a certain angle, and you will as certainly retard the growth and development of the limbs of your boy and girl as you would the limbs of a tree similarly interfered with.

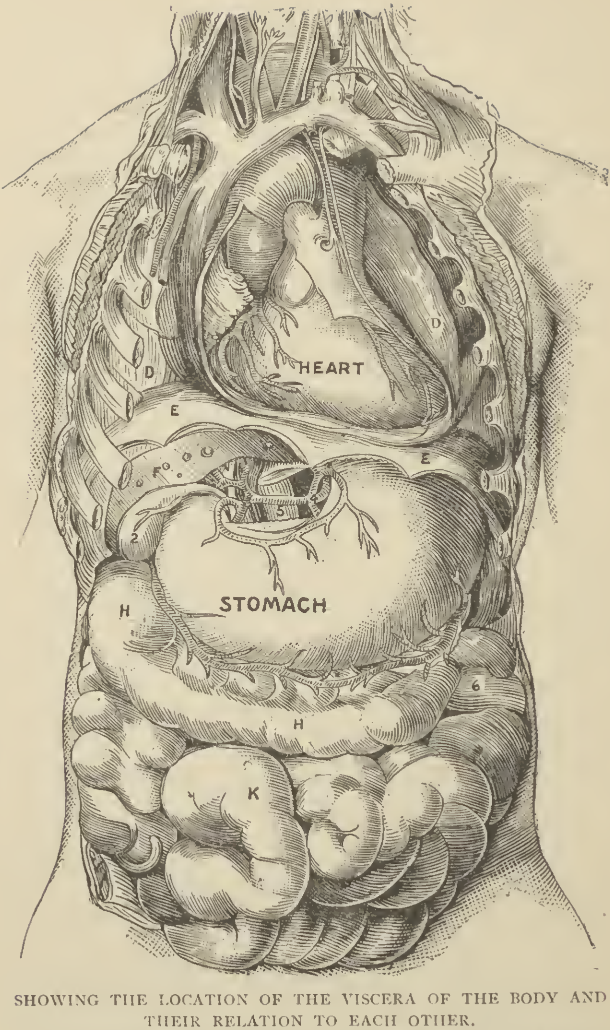
"If physical training is necessary to secure the best types of men, it is equally important as an agent toward securing the fullest development of women. And for their own sakes they ought to have an equal chance with them for realizing the full perfection of their being."

For the degree of physical deterioration her mode of dress, sedentary occupations, indoor life, with her persistent neglect of bodily exercise have

brought the American woman—for it is universally conceded that she takes much less exercise than European women—let her compare the well-developed chest, shapely arm and shoulder, vigorous body, and erect carriage of the galaxy of Grecian beauties, with pipe-stem arms, scrawny necks, angular shoulders, flat chests, narrow backs with curved spines, stooping carriage, and weak walk of—let us say her neighbor and familiar friend.

Remember that the most beautiful women were Spartans, where the idea of personal hygiene or physical culture overtopped every other, and resulted in a type of physical perfection which has never since been equaled.

> "Better to hunt in fields for health unbought
> Than fee the doctor for a nauseous draught.
> The wise for cure on exercise depend ;
> God never made his work for man to mend."
>
> —DRYDEN.



SHOWING THE LOCATION OF THE VISCERA OF THE BODY AND THEIR RELATION TO EACH OTHER.

D. D. Lungs with air expelled. E. E. Diaphragm cut away to show F. Liver cut to show stomach. 2. Gall bladder. H. Large intestine. K. Small intestines. L. Vermiform appendix.

CHAPTER III.

The Maintenance of Health: a Balance of Power between Food Supply, Digestion, and Excretion—The Digestive System—Varieties of Food and the Amount Necessary to Health—Alcoholic Beverages—Constipation—The Kidneys—The Skin and the Complexion—Baths—Menstruation.

"My fahver says it takes food to make brains, an' de reason women aint so smart as men is dat dey don't eat 'nough to know their own minds."—JOHN HABBERTON, *At last, Six Days in the Life of an Ex-Teacher.*

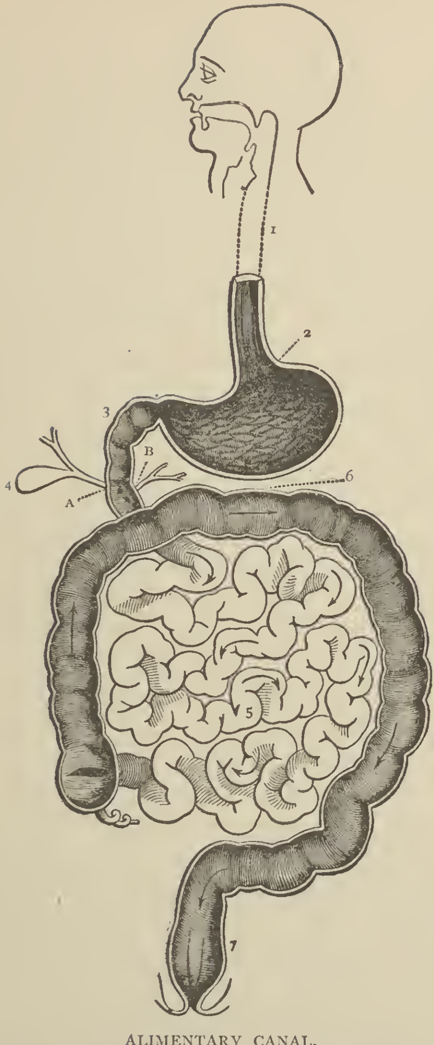
WE have seen that every movement of the body, every breath that we take, every beat of the heart, every thought of the mind, is accompanied by an expenditure of force. That is, that a certain amount of carbon that has been stored up in the body has been burned.

Just as the steam engine requires force to furnish its motive power, and the worn-out parts of the machinery need to be replaced by new, so food is essential to the body for the evolution of force and to replace the material worn out in the use of the machine. But before food can be assimilated by the tissues, that is, be made into brain, muscle, and nerve, it must be con-

verted into a liquid and changed into the same kind of material as the tissues themselves. And this leads us to a study of that part of the body in which these changes take place, namely, the digestive system.

As in a house, different compartments are designed for special purposes, so in the human body each separate part was made to perform some particular kind of work.

In many respects this compartment, which is also called the alimentary canal, may be likened to an intricate hall or passageway winding through an old castle. The alimentary canal has its doors of entrance and of exit: its location in the body is central; it serves as a passageway for the food, and it expands into large roomy compartments where the food is liquefied and is so changed that it can pass through these transparent membranes, incomparably more delicate than tissue paper, into the blood. But the walls of this human passageway form a marked contrast to that of a house, in that these, being living walls, propel or push the contents along from above downward. All this is beyond the control of the owner of these walls, and is regulated by a complicated connection with the nervous system.



ALIMENTARY CANAL.

1. Esophagus. 2. Stomach. 3. Duodenum. 4. Gall bladder. 5. Small intestines. 6. Large intestine. 7. Rectum. 8. Biliary duct. 9. Pancreatic duct. 10. Vermiform appendix.

There are three chief workrooms or laboratories in the digestive system. The first is the mouth. Since this is the only workroom over which the owner has any control, and the work done here is highly important, we will stop to consider it. The work performed here is the minute subdivision of the food by the teeth and its intimate admixture with the saliva, so that a soft pulpy mass is formed.

Several lessons may be learned from a study of the teeth. Infants are born without teeth; they live on milk and do not need them. Each individual has two complete sets of teeth. The first from their whiteness are called milk teeth. They are replaced by the permanent teeth; which have been slowly growing in the jaw and are pushing on behind the temporary teeth; the latter gradually become loosened and are easily pulled out or fall out themselves.

Further, on examining the skulls of various animals you will find that the "style" of teeth varies according to the kind of food which the animal lives on. Serpents, which swallow the food entire and in which digestion is a slow process, have curved spine-like teeth pointing back-

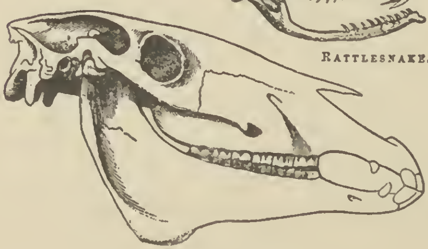
ward, the object of the teeth being to seize the food and prevent its escape.

The polar bear furnishes a good example of the teeth of carnivora, or those animals which

Skull of Polar Bear.

Upper Jaw.

Rattlesnake.

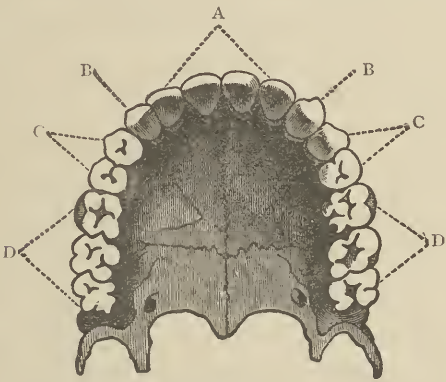


Skull of the Horse.

feed wholly on animal food. The teeth in front are sharp and cut like shears, and are called the cutting or incisor teeth. The curved, conical tusks are for seizing the prey, and these correspond to the canine teeth in the human jaw.

The remainder of the teeth have saw-like edges for tearing the food apart.

The horse furnishes us with an example of an animal which feeds solely on grass and grain; these



UPPER JAW.
A. Incisors. B. Canines. C. D. Molars.

animals are called herbivora. Mastication or chewing, being a grinding process in this case, is performed by the large square molars. The incisors are found as a rule only in the lower jaw, and are for cutting off the grass.

Look at your teeth in a mirror: you will see in front the incisor or cutting teeth, like those of the flesh-eating animals, the canine being imperfectly developed; in the back of the mouth are the molars or grinders which correspond to the

teeth of the herbivora. Thus the teeth themselves show that the human diet should be confined neither to vegetable or animal foods, but should consist of both.

Again, while the teeth may be beautiful, and add greatly to the appearance if properly attended to, they were not meant solely for adornment, but for use. When you consider that the solid food which you put into your mouth must be converted into a liquid, before it can be absorbed by the blood-vessels and be made over into the very tissues of your body, you will readily see how much the process will be hastened by dividing it up into very fine pieces. For a rough illustration, take two large lumps of camphor, place the one entire into a bottle, and divide the other up into very fine pieces, cover both with alcohol, and you will see how much sooner the last will be dissolved than the first. This is always the case when a solid body is subjected to the action of a solvent fluid, since the subdivision into small particles increases the surface which comes in contact with the fluid, and so the substance is more readily attacked and dissolved by it.

The alimentary canal, which is the name of the

various compartments taken together in which digestion is performed, is a musculo-membranous canal of different sizes in different parts, expanding into a large pouch called the stomach, and extends from the mouth to the anus. It has a length of thirty feet. The wall of this canal is composed of three layers, two of which consist of muscle fibers. In the external the fibers are longitudinal; when these fibers contract or shorten the caliber of the tube will be enlarged to admit the passage of food, while on the other hand the inner muscular layer is circular, and a contraction of its fibers will diminish the caliber of the tube, and the food will be propelled onward and downward. It is this propulsion onward of the food, together with the churning movements of the stomach, that constitute the so-called mechanics of digestion.

The alimentary canal is lined throughout its entire length with membrane which begins at the inner surface of the lips, and can be seen lining the compartment of the mouth.

In passing downward the food meets with five different digestive fluids: the saliva in the mouth, the gastric juice in the stomach, and the bile, pancreatic, and intestinal juice in the small intestines.

These digestive fluids act in two ways: they change the solids into liquid, that is, by dissolving them, just as alcohol dissolves camphor, but if the alcohol evaporates, the camphor is found in the bottle unchanged. Now the digestive fluids do more than this. They contain a so-called digestive ferment, which acts upon certain insoluble portions of the food and changes them into soluble. The action is comparable to that of yeast which added to flour and water produces bread, a substance entirely different from any one of the ingredients. Each digestive fluid acts only on some particular kinds of food. This action of the digestive fluids on foods is called the chemical part of digestion.

The chief function or rôle of the saliva is to moisten the food and so assist its mastication and passage down the esophagus. Without the presence of this fluid, both chewing and swallowing become difficult. Probably everyone has experienced the fact that, through the fear of some impending calamity, the mouth became dry and parched and the food stuck in the throat. On the other hand, the sight, smell, or even thought of certain kinds of savory foods causes a flow of saliva, and so the mouth is said to

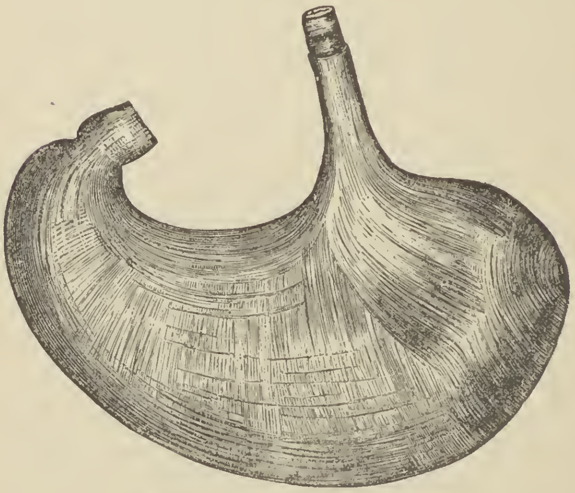
"water." Movements of the jaws without anything in the mouth will also cause a flow of saliva. Besides favoring the mechanical part of digestion, saliva has also a slight chemical action, and being an alkaline fluid is a distinct stimulant to the secretion of the acid gastric juice. Soup will thus be seen to serve a doubly good purpose as an early course at dinner.

In the mouth, then, the food is ground up by the teeth, moistened by the saliva, and finally carried back in a bolus or ball by the tongue. Only the first part of swallowing is under the control of the will. In the second stage the food traverses a region common to the food and respiration. During the passage of the food the air passage is normally closed by a safety valve, but if for any reason the food is delayed here and one attempts to breathe, this valve opens and by the entrance of a particle of food or water into the air passage, a most disagreeable attack of choking may be brought about by the efforts of the respiratory muscles to dislodge the foreign body from the larynx.

From the pharynx or throat the food passes through the esophagus, which is almost a straight tube into the stomach. And this is the

second great workroom or laboratory of the digestive system.

The stomach is a pouch-like expansion of the



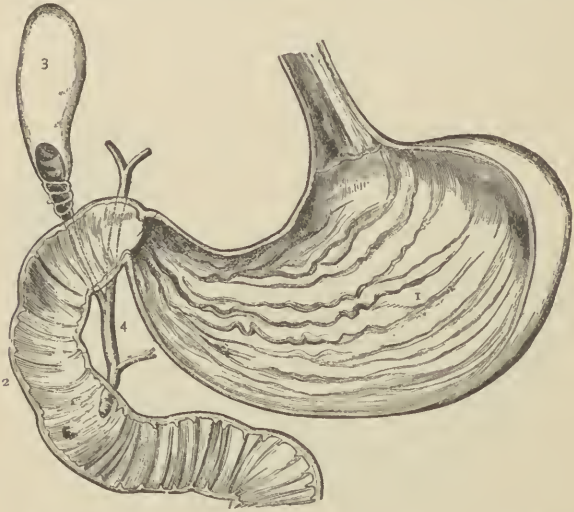
MUSCULAR COAT OF STOMACH.

alimentary canal. It may be felt at the lower extremity of the breast-bone in the triangular space caused by the divergence of the ribs. In the adult the stomach lies transversely, with its greater curvature downward, but so soon as food enters the stomach, it rotates on its long axis so that the greater curvature is turned forward, where there will be more room to work in. An

influx of blood into its vessels takes place, its lining becomes swollen and congested and of a bright red color. At the same time the gastric juice begins to be poured out, and the muscle fibers are so arranged that their contraction causes a sort of a churning movement, by which the food is constantly brought into contact with the gastric juice, thereby hastening its liquefaction, for the food which has been changed into a sort of a pulp in the mouth actually becomes liquefied and dissolved in the stomach. At the end of the stomach, which opens into the small intestine, the muscle fibers form a thick ring; in addition the mucous membrane is thrown into a fold here, so that a valve or swinging doors are formed, which prevents the food from passing into the small intestine before it has been subjected to the action of the gastric juice.

The mucous membrane lining the stomach is very thick and velvety, and lies in longitudinal folds. Its entire thickness is occupied with glandular tubules which secrete the juices of the stomach. These tubules are so closely set as to leave almost no space between them except what is taken up by the blood-vessels. The tubules are surrounded by a network of fine arterial

capillaries from which the glands draw their supplies, as well as by veins and lymphatics which carry off the refuse matter and that part of



MUCOUS MEMBRANE LINING STOMACH AND DUODENUM.

1. Stomach. 2. Duodenum. 3. Gall bladder. 4. Common duct from gall-bladder and pancreas.

the food which has been dissolved or liquefied by the gastric juice. It is also abundantly supplied with nerves. The solvent action of the gastric juice is due to the presence of a ferment body called pepsin.

Gastric juice does not dissolve and chemically change all the food that enters the stomach, but

acts only on that class of food called *proteids*. Proteids form the bulk of muscle and therefore of all meat, and are found in large quantity in eggs and milk. A trace is found in all vegetables. The new substance that is formed by the action of the gastric juice is highly diffusible, that is, possesses the power of passing through animal membranes and does at once pass into the veins and lymphatics of the stomach.

While these changes are taking place, the thick, turbid, grayish-looking liquid is from time to time ejected from the stomach, accompanied by even large morsels of solid, less digested matter. This may occur within a few minutes of food having been taken, but the larger escape from the stomach probably does not begin till from one to two, and lasts from four to five hours after meals, becoming more rapid toward the end, such pieces as most resist the action of the gastric juice being the last to leave the stomach. The movements of even a full stomach are said to cease during sleep. During the intervals of digestion the stomach is quiescent and empty.

The quantity of gastric juice secreted in a man in twenty-four hours has been calculated to be between thirteen and fourteen liters. And a

very practical point is that this secretion of the gastric juice may be wholly arrested by violent emotions. When a hearty meal which you have been eating with the greatest relish has been almost completed, let there be handed to you a telegram containing the news of the death of a friend, or some heavy financial loss; all appetite is at once gone and the dinner lies like lead on the stomach. This shows the important rôle played by the nervous system over the digestion of food.

In the presence of healthy gastric juice and the absence of any nervous interference, the question of the digestibility of any food is determined chiefly by mechanical conditions. The more finely divided the material, and the less the proteid constituents are sheltered by not easily soluble envelopes, the more rapid is the solution. So also pieces of hard boiled egg, which have to be gradually dissolved from the outside, are less easily digested than the more friable muscular fiber, the repeated transverse cleavage of which increases the surface exposed to the gastric juice. Again, the unboiled white of eggs, unless thoroughly beaten up and mixed with air, is less digestible than the same boiled. The unboiled

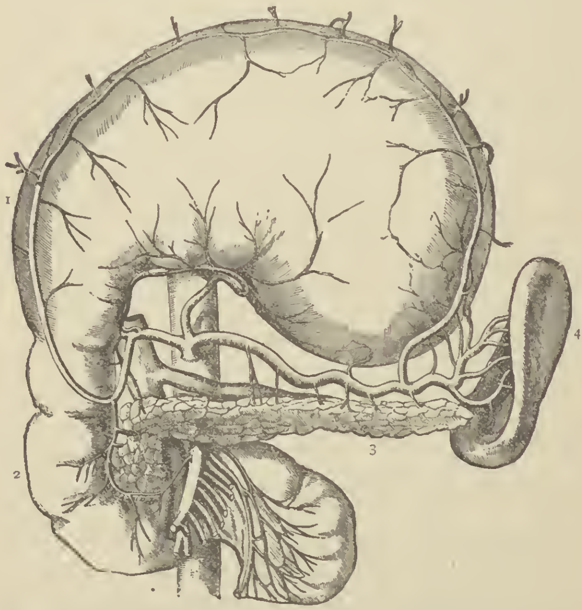
white forms a viscid clotted mass of low diffusibility into which the juice permeates with the greatest difficulty.

Briefly, then, the work done in the stomach is that meats and allied substances are dissolved and transformed into a substance that is capable of passing through membranes, and does pass into the blood at once. If large quantities have been eaten the surplus passes into the intestine, where its digestion is completed. Envelopes containing starches and fats are dissolved, setting these bodies free. The fats are melted by the heat of the stomach and tend to run together in large drops, forming an imperfect emulsion.

And this brings us to the duodenum, which is the name of that part of the small intestine into which the stomach opens. This is the third and last important workroom of the digestive tract. And here digestion is completed; that is, all those substances which resisted the action of the gastric juice are here dissolved or liquefied and so changed as to be capable of passing through membranes and do at once pass into the blood.

Into this compartment are poured the secretions from the liver, which is the largest gland in

the body, and that from the pancreas, a gland situated transversely across the posterior wall of the abdomen. The ducts from these two glands



STOMACH RAISED TO SHOW RELATION TO PANCREAS AND SPLEEN.
1. Stomach. 2. Duodenum. 3. Pancreas. 4. Spleen.

generally unite to form a common duct which opens into the duodenum. There is also a liquid secreted by the mucous membrane of the small intestine. So that in this laboratory there are

three kinds of digestive fluids instead of one, as in the stomach.

The semi-digested acid food as it passes over the biliary orifice causes gushes of bile to flow into the intestine. The alkaline bile, by neutralizing the acid contents of the stomach, prepares the way for the action of the pancreatic juice. The bile is an emulsifying agent, and stimulates the muscles of the intestine to increased action, thereby aiding absorption as well as the onward movement of those insoluble materials which have to be evacuated by the bowel. In cases of jaundice or where the bile is removed by a fistula the fæces are hard and friable and with difficulty expelled. The bile is also said to act as an antiseptic, preventing fermentation and the formation of bacteria. Although the great bulk of bile is reabsorbed by the intestinal tract into the blood and again used in the economy, some of its constituents pass off with the fæces, and are no doubt excrementitious materials that must be gotten rid of.

Pancreatic juice is remarkable for the power it possesses of acting on all food stuffs, starches, fats, and proteids. When the contents of the stomach enter the intestine the pancreatic juice is

secreted with renewed vigor. The secretion is at once stopped by nausea or vomiting.

It is possible that when proteids are taken in excess they undergo pancreatic digestion, and it is also possible that this pancreatic digestion of an excess of proteids is accompanied by a considerable development of bacteria and other organized bodies, which create trouble by inducing fermentative changes in the accompanying saccharine contents of the small intestine. Thus, during the transit of this so-called chyme through the intestine, the proteids not digested by the stomach are changed into peptones, the starch into sugar, possibly being further converted into lactic acid, and the fats are emulsified and to some extent saponified.

The digested contents from the small intestines, as in the case of the stomach, pass into the minute blood-vessels, where they are collected and pass directly to the liver to be subjected to its powerful action, or pass through the lymphatics into the general circulation. The evidence is in favor of the fats passing at once into the general circulation, while the proteids and sugar are subjected to the action of the liver.

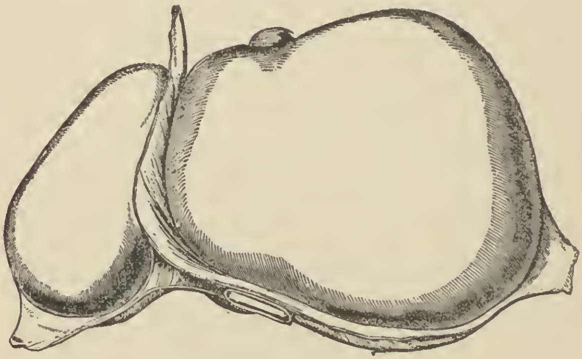
Since the amount of the secretions into the

small intestine is almost as great as the absorption from it, the contents remain liquid throughout its course, while the nutritive elements have all been absorbed by the time the large intestine is reached. Here, owing to the absorption of the water, the contents become converted into the solid fæces which shift in color from a bright orange to a dirty brown. When the bile is cut off from the intestines the fæces become clay colored.

At the same time that digestion is being accomplished, the contents are carried from above downward by the contraction of the muscular coats toward the large intestine. We have seen that the bile acted as a stimulant, causing the so-called peristaltic action of the intestines; if the bile is cut off for any reason, constipation results. But there are other influences which will cause such violent peristaltic action as to bring on an excessive diarrhea, such as a lack of oxygen or an excess of carbonic acid in the blood, or powerful nervous influences.

When digestion ceases there is a cessation of contractions, and the mucous membrane, which was deep red and congested, now becomes grayer, and the whole intestine is restored to its ordinary condition of repose.

The liver is not only the largest gland in the body, but of all the organs which modify the composition of the blood as it flows through



UPPER SURFACE OF LIVER.

them, the liver plays the most important part. It is situated on the right side of the body beneath the lower ribs and extends across the median line into the left side. It is a somewhat concavo-convex body, its convex surface coming immediately into contact with the under surface of the diaphragm, while the under concave surface rests on the stomach and intestines. It measures twelve inches across, six inches from before backward, and has a thickness of three inches. It not only contains one-fourth of all the blood in the body, but after eating it receives

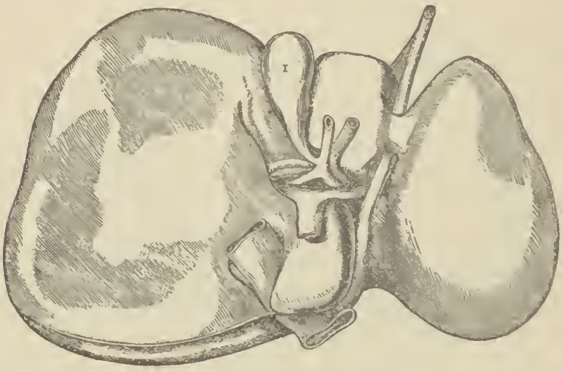
the blood containing the greater portion of the products of digestion from the alimentary canal.

We have seen that one of the functions of the liver was the secretion of the bile which is mainly excrementitious. The elimination of certain constituents of the bile is necessary for the purification of the blood, but it is believed that the main duty of the cells of the liver is the formation of an animal starch, necessary to the nutrition and growth of the tissues.

On the under surface of the liver is the gall bladder, which serves as a receptacle for bile in the intervals of digestion. The semi-digested food passing over the opening of the biliary duct causes a flow of bile into the intestine.

The conditions which will best aid digestion are those that will also best prevent dyspepsia. First, a hearty meal should never be eaten when one is exhausted or even greatly fatigued. Second, the diet must consist of both animal and vegetable food, and there must be a variety in the kinds of food and in its preparation from day to day. Third, the meals should always be served at the same hour every day. Fourth, the temperature of the food and drink should approach that of the blood, that is, be about 100°

Fahrenheit. Fifth, very cold or very hot substances have an injurious effect on the stomach in proportion to the rapidity with which they are



UNDER SURFACE OF LIVER.
1. Gall bladder.

taken, as the gulping down of hot tea or coffee. Sixth, during the meal hour all excitement and business cares should be forgotten. Seventh, the meal should be eaten leisurely, as if that were the only business in life. Eighth, and lastly, it is affirmed on all sides that women do not eat enough—"even to know their own minds."

Here we meet with the second of the three chief causes of the physical deterioration of the American woman. For in the words of Sir Henry Thompson (Food and Feeding), "No

matter how consummate the scheme of the architect, nor how vast the design, more or less of failure to rear the edifice results when the materials are ill chosen or wholly unworthy to be used." How much greater the failure when the supply is wholly inadequate to meet the demand!

A man's work is generally estimated by the amount of muscular effort or mental labor which is shown in day's works, books, or sermons written. Now we have seen that one of the radical defects in the life of the American woman was the lack of physical exercise, and judging the tangible results of her brain work by the number of her writings or original researches, she is equally deficient in mental exercise. Ergo, if a woman does not perform much external labor, she needs next to no food to maintain her body in a vigorous condition. And this proposition brings us face to face with another popular fallacy. The external labor of the body compared with the internal labor required to keep the body alive, is very like man's work compared to woman's,

> "A man's work is from sun to sun,
> But woman's work is never done."

To external labor is given perhaps one-third of the twenty-four hours, while the workings inside the body continue during the entire twenty-four hours.

Be the life that you lead never so indolent, recall the fact that the heart beats seventy-two times a minute. That twice every minute the blood in the body passes through the heart. That eighteen times every minute you breathe in order to obtain a fresh supply of oxygen for the blood. You have seen how complicated were the processes of digestion. These are all the so-called vital processes, that is, those processes which are essential to the life of the body. You have also learned that part of the work or duty of the muscles was to maintain the warmth of the body. But the body is constantly losing heat: through the skin by radiation as from a grate, also through the perspiration; in raising the temperature of the air breathed to the temperature of the body, so that expired is always warmer than inspired air; and lastly, in warming the various ejecta. Now we have seen that not only in the accomplishment of every one of these acts, but in speaking or even thinking there was an expenditure of force which had previously

been laid up in the body. To these must of course be added all external movements of the body. And you now have before you in startling array but a partial list of your daily expenditures.

If you would run a satisfactory bank account, your daily receipts or income should be in excess of the expenditures. And if in the financial life, "The chief part of one's expenditures is the unforeseen," how much more certain this is in the physical life. For there come into the life of everyone accidents and dire emergencies the most unexpected, which make a tremendous drain on the vital forces and under which brain or body not seldom give way. The mammalian animal under full keep always stores fuel as fat. The hump on the camel's back is a mere mass of fat, without any corresponding curve on the vertebral column, and forms a source of nourishment to be used when other supplies fail.

So much for the expenditures. Now we will look at the income or fuel which is to furnish a reparatory juice, to renew the perpetual waste that is constantly taking place in all the tissues of the body. Your daily income to meet these expenditures is made up of the food you eat, the water you drink and the air you breathe.

Chemical analysis shows that the tissues of the human body are made up of proteids, carbo-hydrates and fats in association with various saline and crystalline bodies and water. The really nutritious food-stuffs are composed of materials which are chemically like the tissues, although these are not exclusively destined to replace corresponding substances in the body; for in the body one group is often converted into another. Each of the various substances which we use as food contains in varying proportions several of the different kinds of nutrient material, water being the only one that is commonly used by itself.

The nutritive value of any food depends: first, upon the proportion of the soluble and digestible matters to those which are insoluble and indigestible, and the relative proportion of the different kinds of nutrient stuffs; second, on the mechanical construction, as is seen where the nutritious starch of grain is inclosed in insoluble cases of cellulose which, if not burst by boiling, prevent the digestive fluids from reaching the starch; third, upon the digestibility—for example, cheese, though chemically showing evidence of great nutritive properties, by its

impermeability resists the digestive juices and so is a poor aliment; fourth, owing to the idiosyncrasy of different individuals, and even of the same individual under different circumstances, food may have a different nutritive value.

Fresh meats are highly nutritious; but in order that the nutritive properties should not be lost in the cooking, they must be eaten "rare," that is, either beef or mutton should be at least pink. A roast should be done in a quick oven, so that the albumen will rapidly coagulate on the surface and prevent the escape of the nutrient juices. Or, if the meat is boiled, it should for the same reason be plunged into boiling water. On the other hand, in treating meat to obtain "stock" for soup or in making meat teas, cold water should be used, and the temperature slowly and gradually raised, but not quite to the boiling point, in order that as much as possible of the soluble ingredients may be extracted, and a tasteless, friable mass remain. Poultry and eggs belong to this same class of foods, that is, *proteids*.

Vegetables differ from animal food in containing a much greater proportion of material which for man is indigestible, and a less portion of real

nutritive material. So that in order to get the required amount of nutriment from a purely vegetable diet, it is necessary to consume a much greater quantity. Except potatoes, which contain a considerable amount of digestible starch, vegetables are used not so much on account of their nutritive qualities as for the supply of salts, while some substances contain peculiar oils which act as condiments, as in onions. Peas and beans are highly nutritious but rather indigestible. However, they are valuable articles of food, especially where much exercise is taken.

Milk contains all the classes of aliment essential to health. Being intended for feeding especially during growth, the proportion of nitrogenous substances and fat as compared to sugar is great.

Butter supplies to most people the largest amount of fat they take. It is easily digested by most persons except when it is rancid. It then causes dyspepsia and diarrhea. As a rule it may be said that decomposing fats of all kinds disagree.

While common salt in moderate quantity is essential to the economy, all highly spiced or seasoned foods should be avoided.

The liver makes all the sugar that is needed in the system, when none is taken in the food. In addition to this, all the starch taken as food is converted into sugar in the body. Many foods contain sugar, as honey, molasses, milk, raisins, dates, figs, and indeed all kinds of fruit. When sugar is taken in excess it undergoes fermentation in the alimentary canal, being converted into alcohol, carbonic and acetic acids. This fermentation and its products impede the work of the liver, make the system run with friction, prevent the elimination of effete products, and after long continued use, cripple all the processes of life.

Carbon is the essential element of force, and the fatty principles of food yield in their combustion double the force value of an equal quantity of proteids or starch, for the carbon is stored up in fat to the amount of eighty per cent., while proteids contain fifty-three per cent., and starch only forty per cent. The carbon stored up in the fat of the body has the additional advantage of always being ready for immediate use. Good health cannot be maintained without fat.

Fats and starches are both compounds of carbon, hydrogen, and oxygen, while proteids

contain nitrogen, in addition to these other three substances. As the hydrogen and carbon of coal can only unite with the oxygen of the air when the heat from the flame of a match disintegrates the atoms of hydrogen and carbon in the coal, thus bringing them into contact with the oxygen, so in the body it is believed that the nitrogen does not act as a fuel, but its presence is essential to set up the first beginnings of a fire, not to keep the fire going afterward.

Thus it is seen that no one can live solely or even chiefly on any one of the three great classes of food without great detriment to the economy. It has been estimated that in order to retain his full strength and weight, the entire quantity of food required during the twenty-four hours by a healthy man taking exercise in the open air, is rather more than one pound of fresh meat and eggs, two pounds each of bread and potatoes, or their equivalent in other starchy or saccharine foods, with nearly one-quarter of a pound of butter, lard, and suet, and he should drink a little more than three pints of liquids. But even when the proper proportions of the various constituents are provided for in a dietary, it is equally necessary that certain articles belonging to the same

class be varied from day to day, with the greatest variety of preparation of the same dishes. While the greatest care should be given to the preparation of the dishes, and sufficient thought to their proper combination, the table itself should be sufficient to provoke an appetite. It is an excellent idea to preserve a book of the menus in order that no one dish should be too frequently repeated.

If a woman's strength is below par, the digestive power is enfeebled, and so in addition to what she can eat at the table she should during the twenty-four hours drink say a quart of mixed milk and cream. Part of this may be taken just the last thing before retiring, the remainder between breakfast and lunch, so that the stomach should not be allowed to become entirely empty. The fast from dinner to breakfast is particularly long. In this way the nutrition of the body will be in excess of the disintegration that is going on at the same time, and as a result she will increase in weight and improve in general vigor. As in those below par the system is at its lowest ebb during the morning hours, something should be again taken at this time.

The symptoms of failing health produced by

insufficient diet are the following: There is a gradual loss of flesh, advancing to extreme emaciation. The pulse becomes feeble, the complexion sallow. Exertion brings on attacks of palpitation, vertigo and transient blindness, until at last the patient falls a victim to some sort of wasting disease.

In addition to the water taken in the food which includes tea and coffee, there should be three pints of plain water taken daily. It would appear that a lessened amount of water in the body diminishes the eliminations of carbonic acid by the lungs, as well as the excretion from the bowels and kidneys. The supply of water then becomes a matter of the most urgent necessity.

Alcoholic beverages belong to the acquired and not to the natural tastes. Children dislike the taste of them. The human animal is the only one who resorts to stimulation. With a proper mode of life, the stomach calls for all we can digest.

Women resort to alcoholic stimulants as an analgesic to relieve pain, whether physical or mental, as a narcotic to produce sleep, as a spur to a failing appetite or bodily powers. The majority of women patients say that they first

used alcohol in the shape of whisky, brandy, or gin to relieve pain at the time of the menstrual period. The pain that is caused at this time by a chilling of the body would be as effectually removed by drinking a cup of hot tea, taking a mustard footbath and going to bed with a hot water bag to the abdomen. If the pain is intense and constant, recurring every month, it doubtless comes from some local inflammation, and if these simple remedies do not relieve it, the alcohol simply veils the real trouble, and the woman is losing valuable time by not consulting a physician at once.

As to the use of alcohol to blunt the nervous sensibility due to mental suffering of any kind whatever, it is the testimony of the entire medical profession that this is the greatest cause of inebriety or drunkenness among women of all classes of society. Sleeplessness generally arises from some well-defined physical cause, very frequently to inaction of the liver, and the proper remedial agents should be used to remove the cause. The same thing holds true of loss of appetite, and while at first alcoholic beverages increase the appetite as the amount taken is increased, distaste for food is created, the system languishes

under an insufficient food supply, and the original aim of increasing the appetite is defeated.

As to taking stimulants to do more work than one could otherwise accomplish, it is by means of stimulants that woman can accomplish her physiological ruin more quickly than in any other way. By a bill a woman anticipates her income and utilizes a portion of her capital, otherwise beyond her reach; by stimulants a woman brings into action a portion of her reserve fund of energy, otherwise equally beyond her reach. In each case the person is enabled to draw on her capital. But it is obvious that if she does not repay these loans to herself, she will sooner or later be bankrupt. A stimulant enables a woman to use to-day what she ought not to consume until to-morrow. This process is not illimitable. So woman's powers fail; the final catastrophe is usually precipitated by some external force, some sudden disease or illness. It requires strenuous, unaided efforts for a woman to reach her reserve capital without the aid of stimulants, though it is possible to do so, especially for a woman of a nervous temperament, and a perfect and genuine abstainer may die physiologically bankrupt. But alcohol will enable her to do it much more

quickly and effectually, and tea or coffee when taken to excess will do the same thing. There will be neuralgia, sleeplessness, palpitation of the heart, and muscular tremors. All stimulants by virtue of their nature as stimulants have certain injurious effects.

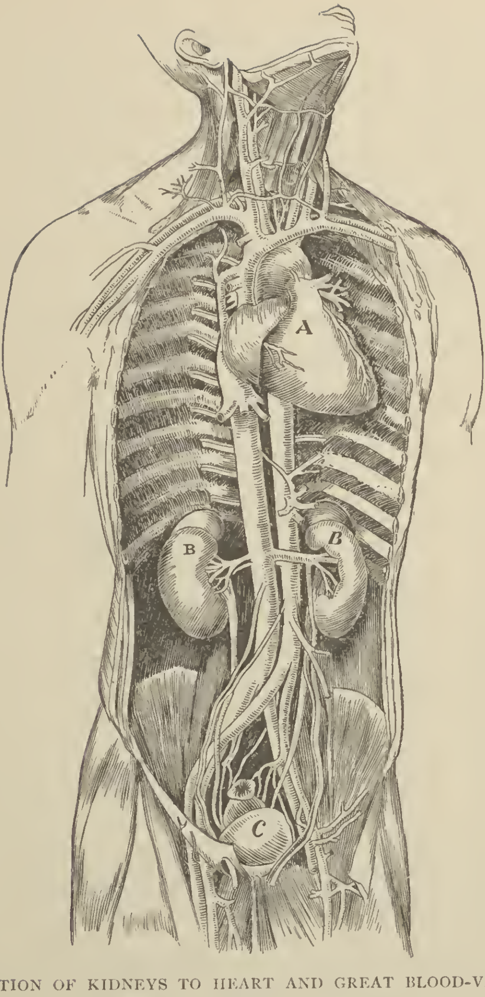
The result of a series of experiments of Dr. Parke's (Alcohol as an Article of Diet in Health), were as follows: "By quickening the action of the heart, it shortens the interval of rest and therefore interferes with the nutrition of the heart. It also produces palpitation and breathlessness. That *any amount* of alcohol, though it did not produce neurosis, would act injuriously by increasing unnecessarily the action of the heart, which labor alone sufficiently augmented. It acts on the nervous system by lessening the rapidity and the delicacy of the impressions, as well as by lessening the power of control of a train of thought. Further, by this same blunting of the nervous system, voluntary muscular power is impaired and the finer combined movements are less perfectly made. It causes a lowering of the temperature of the body. And although it is taken to overcome the effects of exposure to cold it has been

learned that persons who habitually take it are less able to resist the exposure to cold."

Every housekeeper knows that, although her furnace is in perfect working order, the draughts good, and it is supplied with coal, if it is allowed to become clogged with cinders or choked with ashes, the fire instead of burning gradually dies out. And the only way to procure a good fire is to have the cinders and ashes *regularly* removed, at not too long intervals, as well as to have it regularly supplied with coal. Yet, strange to say, while a woman would consider herself an incapable and shiftless housekeeper did she not bestow all this care on her furnace, which could at any time be replaced by a new one, she forgets that her own physical machine must be quite as carefully looked after if it is to be kept in good running order.

The waste matter of the body is gotten rid of through the bowels, the kidneys, the skin, and the lungs.

The refuse matter which collects in the lower bowel must be evacuated *once every day*. It might seem superfluous to mention this were it not a notorious fact that the great majority of women are constipated, a bowel movemen tonly



RELATION OF KIDNEYS TO HEART AND GREAT BLOOD-VESSELS.
A. Heart. B. B. Kidneys. C. Bladder.

taking place every second or third day. This means that the flow of blood from the veins of the bowel is prevented and piles are likely to be caused; that the unfortunate womb is pushed wherever the compressed waist, full bladder, and packed bowel have left room for it; that the digestive system is clogged by the non-removal of worn-out material, and the blood is constantly reabsorbing matter which is poisonous to the body. Decomposition goes on, foul gases are generated, and a slow, insidious poisoning goes on without being suspected by the sufferer. Bad drainage and defective sewerage within the body produce infinitely worse results than when the same occur outside the body.

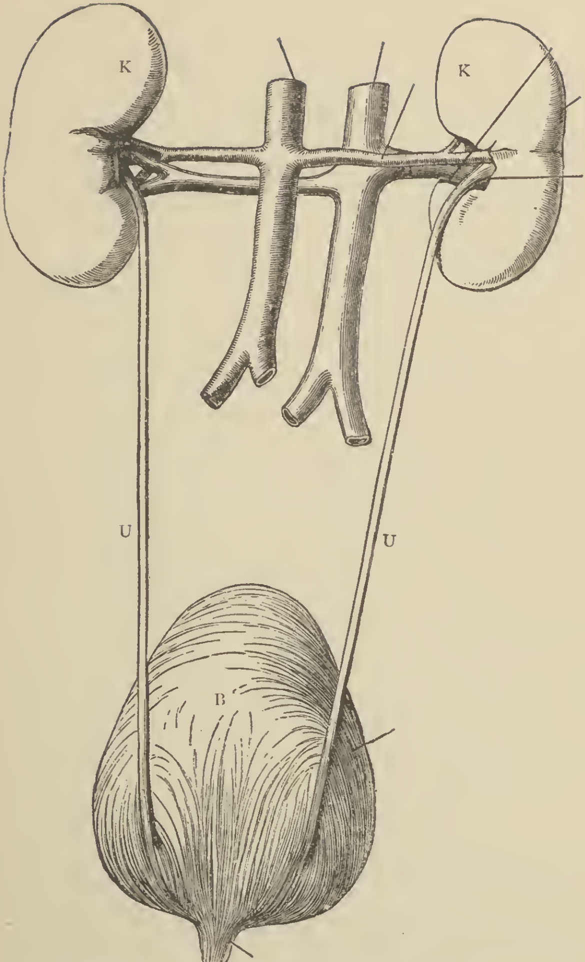
To secure a free daily bowel movement *regularity* is an essential condition. Nothing must be allowed to interfere with the evacuation of the bowels at the same hour each day. Such a habit once established will force itself on the attention and make regularity a necessity.

Much can be done to overcome obstinate constipation by exercise and selecting such food as stimulates the peristaltic action of the intestines, as cracked wheat, oatmeal, corn and graham bread, fruit, and vegetables. Strong coffee, but

tea to a much greater degree is constipating. A large glass of hot water taken one hour before meals will often keep the bowels open when medicines have failed. The small amount of water taken by women is a fertile source of constipation.

We have seen, too, that water is needed to keep the kidneys properly flushed. The kidneys are quite as important as the bowels in removing poisonous matters from the blood, and drain the water off from it as well. The kidneys are constantly at work. The urine secreted by them passes through fine tubes, one on each side of the body, to the bladder. The amount of urine secreted during the twenty-four hours should be three pints; of course it will be less if the quantity of water taken is insufficient. The bladder acts as a reservoir for the urine and should be emptied at least three times a day. If it is allowed to go longer than this, it is apt to displace the womb and the walls of the bladder itself to become paralyzed.

The skin is the third great excreting organ. It is a thin, leather-like substance, divided into two layers. The superficial layer is the portion that raises up when the hands are blistered. In



SHOWING URETERS OR FINE TUBES PASSING FROM THE KIDNEYS TO THE BLADDER.

K. K. Kidneys. U. U. Ureters. B. Bladder.

this layer we find the opening of the ducts, or pores of the skin, which are really situated in the next layer, the so-called true skin. There are two kinds of glands, the sweat and oil glands; these are in the form of hair-like tubules, and it has been estimated that the total length of these tubules covering a man of ordinary size is about twenty-eight miles.

These glands, like the kidneys, help to purify the blood by carrying off worn-out matter which has become injurious to the body. In addition to this, these glands keep the skin moist, and help to regulate the temperature of the body. So we find that, in the hot weather, when the temperature of the body would otherwise naturally be higher, the perspiration is much more profuse. When an excess of water is taken the amount of perspiration is increased, and so it regulates the volume of blood. Again, if the kidneys should be diseased, the skin, if in good condition, will do part of their work.

The effect of stopping twenty-eight miles of sewer pipes can easily be imagined. This has been tried in the case of dogs; all the hair was cut off and the entire surface of the body varnished over. The experiment proved rapidly fatal.

The skin can only be kept in a good condition by bathing. With insufficient care as to baths, there is a local irritation of the skin by dirt, worn out epithelial scales, dried perspiration, and exuded oily matter. The impure condition of the blood which is caused by the blocking up of these glands gives rise to most of the troublesome skin diseases.

For purposes of cleanliness a hot bath should be taken at least once a week. Soap is necessary to remove the oily matters, and for this purpose nothing is better than white castile. If you would avoid all manner of skin diseases always carry your own soap with you, since you never know who last used that piece of soap in the hotel room which you now occupy, nor what was the matter with him. Abroad the hotels do not furnish the guests with soap, sensibly thinking that everyone will prefer to furnish her own.

A plunge bath should not be taken within two hours after a hearty meal, nor should it be too long continued, especially if the water is very hot, otherwise it will prove debilitating. The best time for the hot plunge is just before retiring, since it increases the flow of blood in the skin and opens the pores. Going out at once

into the cold air would increase the danger of chilling the body and react injuriously upon the internal organs. But if the woman is sufficiently strong, after taking her hot bath she may turn on the cold water, thus gradually reducing the temperature of the water until it is cold, or she may follow the hot bath with a cold shower bath. Either of these will greatly reduce the danger of "chilling" following the bath.

A cold plunge can only be borne by the robust, and a cold plunge before breakfast should be taken by none but the very vigorous. Those who are not sufficiently strong to bear the shock of a cold plunge bath will find a delightful stimulating effect in the cold sponge bath. The temperature of the room in which this is taken must depend on the vigor of the woman. By taking a glass of hot water or hot milk, the average woman can take this on rising in the morning. Any cold bath must be followed by friction with a rough towel until the skin is in a glow.

While, if used in suitable cases and at suitable times, cold baths are invaluable aids in promoting and preserving health, they may, if employed by the wrong individuals at improper times, or with excessive frequency, become dangerous

agents, causing even fatal results. The test for the advantage or disadvantage of the cold bath is the occurrence or non-occurrence of this reaction or glow as soon as the skin is dried. When the glow is felt promptly and is followed by a pleasurable sense of warmth, the bath does good and may be repeated, but if reaction takes place slowly or not at all, the person feeling chilly, and the lips, the skin beneath the nails, and the external surface generally continues for some minutes bluish, the bath does harm. This means that the loss of heat has been so great that the internal heat production has been exhausted; that the body has thus been deprived of heat it cannot afford to lose, and a great tax has been imposed upon the heart.

Cold baths should never be taken when the body is exhausted, neither during nor just before menstruation, and they should be used sparingly by pregnant women, who must wholly avoid the cold plunge. Elderly people should not take a bath below 70° Fahrenheit. Persons of a nervous temperament and those with heart disease should be very cautious in the use of cold baths, the cold plunge being wholly avoided.

Women who study their complexions—and

there is nothing that will so completely mar a face with even perfect features as a skin that is blotched or dotted with pimples—will avoid the use of cosmetics. These, if not positively chemically injurious, stop up the pores of the skin, thus interfering with its action. Cold water is likewise to be avoided. Hot water should be used with soap, followed by friction with a rough towel. Equal parts of glycerine and water increase the softness of the skin. This keeps the pores open and removes the black "pin-heads," which is nothing more or less than a pore stopped up with dirt.

Still more efficient is the vapor or "Turkish" bath. The Greeks, who possessed such beautiful satin skin, after their exercise took a daily bath. There was first friction with flour or soda, followed by the hot bath, the cold plunge, then friction or massage with oil or ointments. The advantage of this combination is seen in the increased activity of the function of the skin. The sheet of oil prevents the danger that might otherwise follow from the sudden change of temperature, while the oil acts as a food and is particularly valuable in cases of emaciation, so that the body increases in bulk and the general

circulation is improved. The manipulation is particularly invigorating and soothing when the body is exhausted.

Scarcely less necessary to the appearance, as well as comfort of the individual, than attention to the skin, is the proper attention to its appendages, namely, the nails, hair, and teeth. In these days, when so much is said about bacteria, no one would think of allowing the nails to grow immoderately long, nor to consider her toilet complete without the use of a nail brush. For the same reason the hands should be washed very shortly before going to the table.

Before retiring the scalp should be *well brushed* and the hair left in a loose braid down the back. Steel hair pins cut the hair, and one rests much better with her hair down. The head should be well washed once a month. This is best done with a little water of ammonia in a large bowl of warm water. If care is taken to wash the ammonia well out of the hair, no harm can be done. A little alcohol put on while the scalp is being rubbed with a towel will hasten the drying process and prevent the tendency to take cold. If there is a tendency to harshness, follow the alcohol with a small amount of glycerine. If the

hair is properly cared for in this way, the fine comb will be found unnecessary. And since its use is positively deleterious to the scalp it should be relegated to ancient history.

Beautifully kept teeth add not a little to the charms of a woman. This means the use of a toothpick, not a pin, after each meal, being careful to go closely around the gum of each tooth. But the teeth are so closely set together that this is not sufficient to remove the very slight traces of food from between them. For this purpose, it is necessary to use waxed dental floss, preferably after every meal, but certainly once a day. For even where the toothpick, toothbrush, and tooth powder are scrupulously used, these minute particles of food left between the teeth are sufficient to cause decay of the teeth and indigestion. The heat and moisture of the mouth acting upon these particles of food cause its decomposition, setting up a so-called acid fermentation. And it is this acid that causes the decay of the enamel and finally of the teeth. The decayed tooth gives a still further lodgment to particles of food, and these, left to decompose, give rise to the most offensive gases, giving fetor to the breath. This is not only offensive to all

around, but does great harm to the woman herself who breathes and rebreathes this fetid air, as this poisons the blood and so injures the nervous system.

If there is a cavity in a tooth, seek a good dentist at once, for the sake of the tooth, to prevent the formation of an abscess, which is excruciatingly painful, and for the sake of the entire body, since nothing is more demoralizing to body or morals than the fine tortures of a toothache.

If acids are prescribed by your physician, they should be taken well-diluted and through a glass tube. All acids and very cold substances are injurious to the teeth. The tartar always does harm and should be kept carefully removed. Hot water is a better solvent than cold, hence it should be used in cleaning the teeth; the brush should be serrated and not too hard.

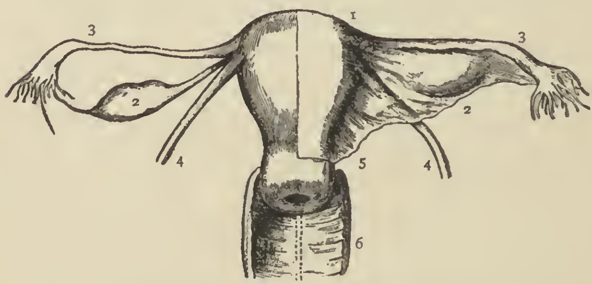
We now come to consider another physiological function, but this one is peculiar to women. It is that of menstruation, or the monthly period. According to the oldest, as well as the most recent theories, this is an excretory process. The Mosaic ritual indicated

that the impure matters which collected in the woman's blood were discharged in the menstrual flux, which was therefore a purification. It is now known that the flow of blood is a secondary factor. As in the alimentary canal, the mucus secreted plays an important part in excretion, by entangling and so carrying with it to the rectum indigestible and other possibly harmful solid particles as microbes. So we see that the uterus not merely cleans itself by the secretion and expulsion of mucus, but during menstruation it discharges all the superficial part of its mucous membrane.

The organs that are concerned in the process of menstruation are the ovaries, the Fallopian tubes, and the uterus or womb. The uterus is a somewhat pear-shaped, thick-walled, hollow, muscular organ. It is situated in the middle of the pelvic cavity between the bladder and the lower bowel. It is held in place by broad elastic bands, which go to the different sides of the pelvis; it is also in part supported by the structures beneath and above it. But so loosely is the uterus held that it is easily pushed about, as for instance by a full bladder or packed bowel. And, persistently allowing the bladder to become overful, or a

failure to have a regular daily evacuation from the bowels, are prolific sources of displacement of the womb, one of which is a bending of the womb upon itself so that menstruation becomes painful.

Again, when no constrictions are placed about

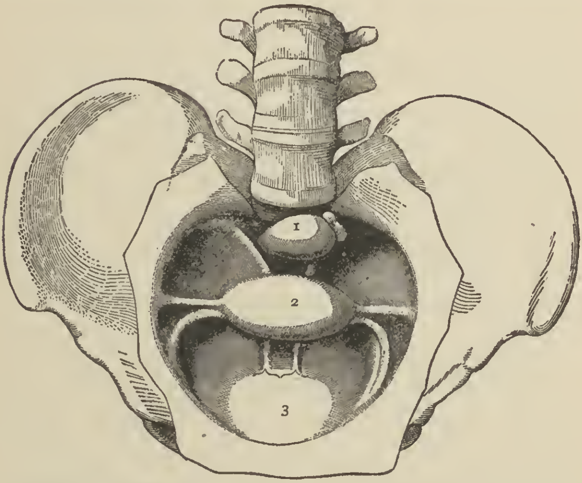


THE UTERUS AND ITS APPENDAGES.

1. Uterus. 2. 2. Ovary. 3. 3. Fallopian tube. 4. 4. Round ligament. 5. Broad ligament. 6. Vagina.

the waist, the uterus moves freely up and down with every respiration. So distinct and with such regularity do these movements take place, that an operator by watching the movements of the uterus can tell the effect that the anæsthetic is having on the patient's breathing. These so-called respiratory movements of the uterus play a very important rôle in the circulation of that organ and the return of the venous blood to the heart. Anything which interferes

with the movement, as the use of corsets or tight bands around the waist, prevents the free return of the venous blood. The uterus becomes con-



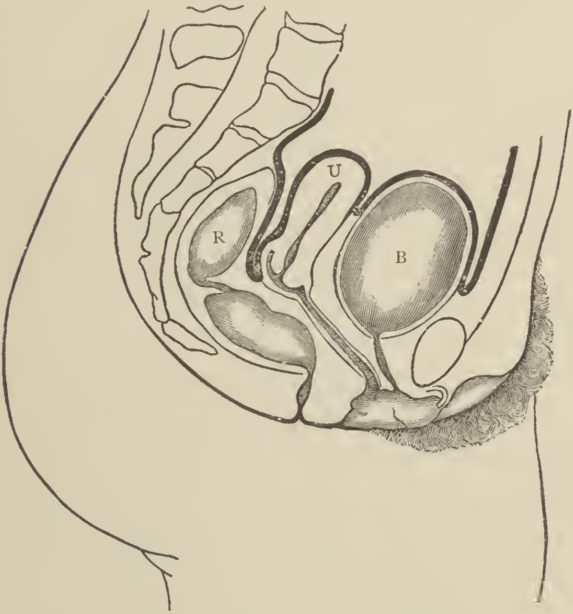
LOOKING DOWN ON THE PELVIC CONTENTS FROM ABOVE.
Ligaments seen passing from Uterus to the sides of Pelvis. 1. Rectum. 2. Uterus. 3. Bladder.

gested, and through the constant abnormal weight of the organ itself as well as the pressing down upon it from above of the superincumbent organs, the uterus is pushed down below its normal position, the ligaments whose duty it is to hold it up become relaxed, and the unhappy woman suffers all the agonies that are attendant on the "falling of the womb." For this reason this disorder is

met with in women who have never borne children, as well as in those who have.

During the menstrual period the ovaries and the uterus are intensely engorged with blood ; the surface of the ovary is broken through by the escaping ovule, which passes through the Fallopian tube into the uterus and is discharged from thence with the menstrual flow. It is on account of this intense congestion of the generative organs that all excessive muscular exercise, as gymnastics, horseback riding, dancing, and prolonged walks must be avoided at this time. On the other hand, it is not only not desirable, but would be actually detrimental to her well-being for a woman in good health to give up all exercise. Again, because of this physiological congestion, all chilling of the body must now be particularly avoided. A chill of the surface means a contraction of the blood-vessels of the skin and an engorgement of the already congested and now sensitive pelvic organs. While wetting the feet or a thorough chill frequently causes a sudden checking of the flow, which is followed by an inflammation of the uterus as well as of the surrounding tissues. It follows, then, that not only cold plunge baths, but even the cold sponge

bath must be prohibited during menstruation. On the other hand, anyone who is accustomed to



ANTERO-POSTERIOR SECTION OF BODY.
Showing relation of Bladder, Uterus, and Rectum. B. Bladder. U. Uterus. R. Rectum.

a daily cold sponge bath for three weeks of the month, will be greatly annoyed if all bathing except of the face and hands is omitted during the fourth week. No harm and much comfort will be derived from an occasional warm sponge

bath taken in a well-heated room. While a daily washing of the vulva with warm water does not affect the flow, and is productive of great comfort by removing any local irritation and general nervousness caused thereby.

As a rule the monthly flow recurs every twenty-eight days, and should last from two to six days. For the first few hours the flow is usually slight in quantity and may be light in color; on the second and third days it reaches its height, and the flow is profuse and dark but should never be clotted; after this it gradually ceases. A flow lasting less than two, or more than six days generally indicates local or general disease. The amount of the flow varies from five to ten ounces. If less than five or six or more than eighteen ordinary napkins are pretty well saturated through, the amount may be considered abnormal.

The menstrual flow first appears between the ages of thirteen and fourteen, and in a healthy woman should continue until the age of forty-four to forty-eight years.

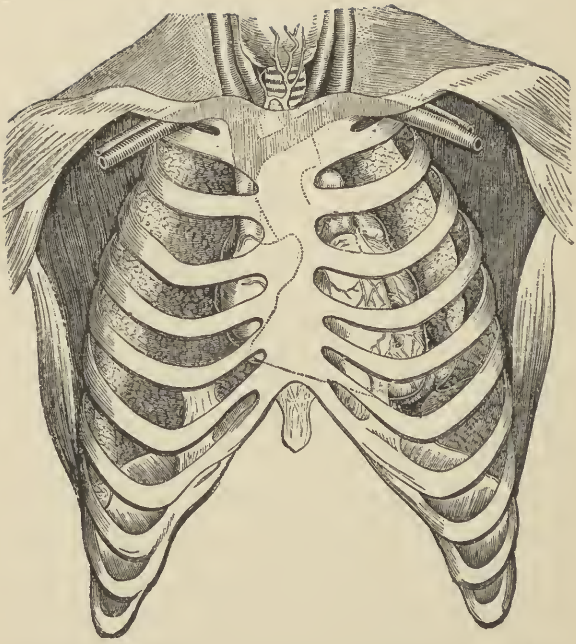
The premonitory symptoms of the monthly flow should not be so marked as to cause the individual discomfort. The first indication of

the return of the period should be the appearance of the flow. There is a feeling of abdominal fullness with lassitude, and sometimes slight headache. The temperature is lower and the pulse slower than at other times. This lowered tone of the system is an additional reason for increased care against exposure in cold or wet weather.

It has already been stated that the excretory organs, by constantly eliminating from the system the worn-out material, keep the machine healthy and in good working order. Kept within natural limits, this elimination is the source of strength and health; beyond these limits the menstrual flow becomes an actual hemorrhage, that by draining away the life becomes a source of weakness and disease. No physician would dare bleed a man or a woman once a month, year in and year out, for twenty-five or thirty years. But through ignorance or folly many girls do this for themselves. This excessive flow, aside from actual local disease, is brought about by excessive muscular exercise during menstruation; by the use of all stimulants, whether alcoholic beverages or quinine; as well as by thinness of the blood. When the flow

is excessive, it must be considered a pathological condition, which needs the physician's attention. Rest in the recumbent position is the first essential; the diet must be plain and unstimulating, and attention must be paid to the condition of the blood.

Painful menstruation is an equally pathological condition which may be the result of exposure to wet or cold. For either this or checked menstruation a cup of hot tea should be taken at once, followed by a hot mustard footbath. The equilibrium of the circulation will be most quickly restored by going to bed and placing a hot water bag over the abdomen. If this treatment does not relieve the pain, or if pain recurs month after month, it is the sentinel which points to some displacement or local inflammation, which if left to itself is sure to grow worse.



RELATION OF HEART AND GREAT VESSELS TO THE WALL OF THE THORAX.

The collapsed lungs are drawn slightly aside.

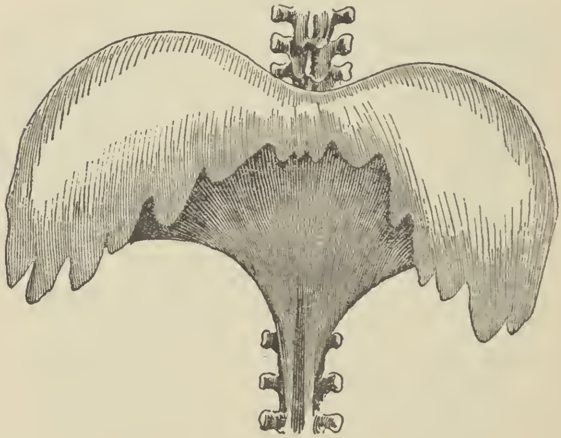
CHAPTER IV.

The Importance of Good Chest Development and Ventilation in Order to Obtain a Vigorous Circulation and a Healthy Body—The Blood—The Circulatory and Respiratory Apparatus—The Changes in the Air Caused by Respiration—Ventilation.

"I am convinced that he who devotes two hours each day to vigorous exercise will eventually gain those two hours, and a couple more into the bargain."—WASHINGTON IRVING.

WE have seen, in our studies of the bony skeleton, that the thorax or chest is a cone-shaped, distensible cage; formed of bones, elastic cartilage, and muscles. That the base of the cone is situated in the region of the waist and that here, too, the chest is most distensible. That the heart, lungs, and great blood-vessels completely fill the cavity of the thorax. The thorax is converted into an air-tight cavity by means of muscles. The base is made up of one huge muscle, the diaphragm. This is attached at its border to the ribs and posteriorly to the vertebræ. It is the diaphragm which separates the cavity of the chest from that of the abdomen. When the diaphragm is relaxed it has a concavo-

convex shape, the convexity being directed toward the chest, and the heart and lungs rest directly on it, while the concave surface covers or rests on the liver. The height of the diaphragm is



THE DIAPHRAGM.

constantly varying during respiration. Its height also varies according to the degree of distention of the stomach and intestines and size of the liver.

Further, we have seen that the blood is the great medium of exchange between all parts of the body. It is at the same time the nourisher and scavenger of all the tissues. After the food has been liquefied and changed into

new substances in the digestive system, it is poured into the blood. From the blood, all the tissues draw material to renew their own worn-out parts, and other material which they store up as so much latent force, which, when it becomes united with the oxygen of the blood, becomes active force as heat and motion. The blood holds in suspension a vast number of minute cells or corpuscles. It is to these red corpuscles that the blood owes its color and its power of carrying oxygen to the tissues. The blood constitutes about one-thirteenth of the weight of the body. Of this one-fourth is distributed to the heart, lungs, and great blood-vessels; one-fourth to the liver, one-fourth to the skeletal muscles, and the remainder to other organs.

In order that the blood may be a satisfactory means of communication between all the tissues of the body, two things are necessary: First, there must be through all parts of the body a flow of blood of a certain rapidity and general constancy. Second, this flow must be susceptible of general and local modifications.

The circulatory apparatus consists of a central force and suction pump, the heart, and a series

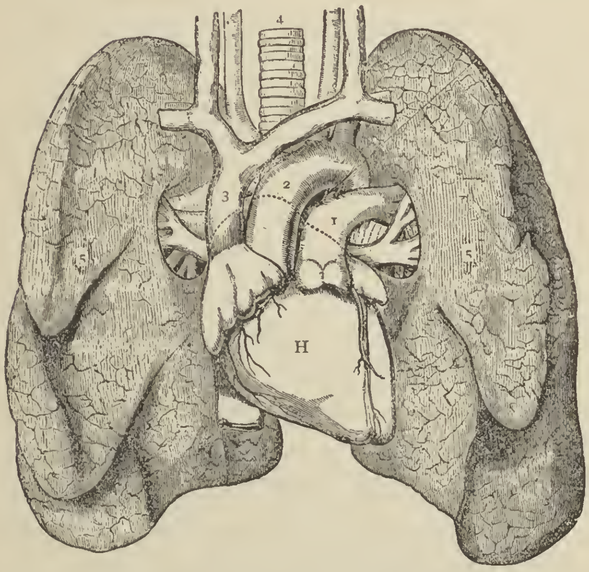
of tubes that grow finer the further from the heart they are situated, and sub-divide like the branches of a tree. A good idea of the circulatory system can be had, by imagining the roots of two trees placed closely base and base together, while the tops of the trees are sufficiently arched together so that their finest twigs barely touch each other. The heart corresponds to the two roots, the large blood vessels to the trunks and large branches, and the capillaries or those blood-vessels which are of a hair-like size, to the very finest twigs.

The heart is a hollow, somewhat cone-shaped muscular organ, placed between the two lungs; it is situated more or less obliquely in the chest immediately back of the breast-bone. Roughly speaking, the base of the heart corresponds to the right edge of the breast-bone, while the apex lies a little below and to the right of the left nipple.

The heart is divided into a right and left side. The left side forms the force pump, whose motive power is supplied by the contraction of its own muscle fibers. The bright red blood, with its fresh supply of oxygen, hence its bright red color, flows from the lungs into the left heart,

THE CIRCULATORY SYSTEM.

which then contracts, as you would squeeze a bulb in your hand, and forces the blood into the arteries of the body. The blood-vessels which



FRONT VIEW OF HEART AND LUNGS.

H. Heart. 1, 2, 3. Great blood-vessels. 4. Trachea or wind-pipe. 5. 5. Lungs.

carry the bright red or newly oxygenated blood to the tissues, are called arteries. They are a series of elastic tubings ; hence the finer the tubing the greater is the resistance which has to be overcome by the force of the heart's beat. So

that during violent exercise, when the contraction of the muscles causes a pressure on the minute arteries and capillaries situated in the muscles, the more forcible must be the beat of the heart to overcome this additional resistance. Likewise when the surface of the body is suddenly chilled, as by a plunge into cold water, all the vessels situated here contract, and more work is again thrown on the heart.

The equilibrium of the circulation is maintained by the overflow of blood from the capillaries into the veins, and it is the duty of the left heart to keep the whole arterial system in a state of over-distention. The three chief factors in the mechanics of the circulation are the force and frequency of the heart's beat, the peripheral resistance, and the elasticity of the arterial walls. A disturbance between these relations brings about abnormal conditions.

The average frequency of the heart's beat, or pulse, is seventy-two times a minute. It is increased by exercise; it is quicker in a standing than a sitting, and in a sitting than a lying posture. It is quickened by meals, and on the whole is quicker in the evening than in the early morning. Independent of muscular exertion, it is

quickened by great altitudes. It is said to be quicker in summer than in winter. Its rate is profoundly influenced by mental conditions. The whole of the blood of the body passes through the heart in thirty-two beats, that is, in less than half a minute. The greatest part of this time is spent in the capillaries, where the tissues are obtaining their fresh supply and discharging their waste matter into it.

The heart, great blood-vessels, and lungs, are placed in an air-tight cavity, and are subject to the same pumping action of the respiratory movements. The inspiratory muscles elevate the ribs at the same time that the diaphragm by its contraction pushes the contents of the abdomen downward. The cavity of the chest so enlarged causes the pressure around the heart and great blood-vessels within the chest to be less than that on the blood-vessels outside the chest, hence during each inspiration the venous blood is sucked back into the right side of the heart. During forced expiration, the intra-thoracic pressure may be so great as to afford a distinct obstacle to the flow of the blood from the veins into the heart.

The tissues deprive the blood of its oxygen, so that which flows back to the heart in the veins is

blue. The right heart then sends this blue blood to the lungs that it may get rid of its carbonic acid, which not only is not needed, but is absolutely injurious in the body, and to receive a fresh supply of oxygen which has been carried into the lungs in breathing.

The lungs are the essential organs of respiration, or the ventilators of the body. They are two in number, separated from each other by the heart, are placed in a semi-distended state in the air-tight thorax, which we have seen, they, together with the heart and great blood-vessels, completely fill. The lungs ultimately consist of air cells, surrounded by dense plexus of capillaries and nerves. The air cells communicate with the exterior through the bronchial tubes, trachea, and larynx.

The larynx is the organ of voice, and forms the first part of the air passage. It is situated between the trachea and base of the tongue, at the upper and fore part of the neck, where it forms a considerable projection in the middle line called Adam's apple.

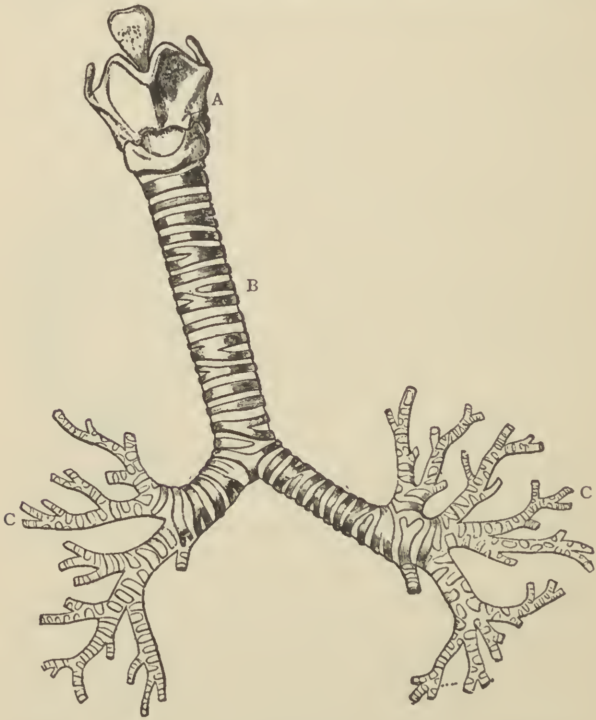
The trachea is a cylindrical tube which extends from the larynx downward about 4½ inches, where it divides into the right and left branches.

The branches on entering the lungs divide and sub-divide, until finally they terminate in a lobule which is composed of air cells and intercellular passages.

We have seen that in inspiration the cavity of the thorax was enlarged by an active contraction of the muscles, in consequence of which the pressure of air within the lungs becomes less than that of the air outside of the body, and this difference of pressure causes a rush of air through the trachea into the lungs, until an equilibrium of pressure is established between the outside air and that within the lungs. This constitutes *inspiration.* Upon the relaxation of the inspiratory muscles, the elasticity of the chest walls and lungs, aided perhaps, to some extent, by the contraction of certain muscles, causes the chest to return to its original size. In consequence of this the pressure within the lungs now becomes greater than that outside, and thus the air rushes out of the trachea, until the equilibrium is once more established—*expiration.*

THE LARYNX.

During inspiration the size of the thorax is increased in its antero-posterior, transverse, and



FRONT VIEW OF CARTILAGES OF LARYNX, TRACHEA, AND BRONCHIAL TUBES.
A. Larynx. B. Trachea. C. C. Bronchial tubes.

vertical diameters. In forced inspiration the cavity of the thorax is increased from two to three inches, partly by the elevation of the ribs

and partly by the descent of the diaphragm, due to the contraction of its muscular fibers. In contracting, the diaphragm presses upon the abdominal viscera, pushing them downward about three inches, so that those organs are no longer protected by the ribs, and a projection of the flaccid abdominal walls occurs. The least chest girth of the adult woman—that is, the under-arm girth around the chest—consistent with health is twenty-eight inches, and this girth must be enlarged three inches on forced inspiration. In ordinary respiration the waist expansion should be half an inch to one inch. While during great muscular activity it should be from one and a half to three or four inches.

In women the movement in the upper part of the chest is very conspicuous, the breast rising and falling with every respiration. Whereas in children and men the movements are almost wholly confined to the lower part of the chest, and are called diaphragmatic in contradistinction to those seen in women, which are called thoracic. It is now the opinion of many observers in this country and in Europe that the habit of thoracic breathing in women has been brought about by constricting the waist and the lower ribs. Obser-

vations made among the Indian and Chinese women show that abdominal is there the type of female breathing, *and* civilized women who wore no corsets had relatively good abdominal breathing. Further, that a thoracic type of breathing can be produced in man by putting him in a corset.

In normal breathing the current of air which passes in and out of the lungs travels through the nose, not the mouth. The ingoing air, by exposure to the vascular mucous membrane of the narrow and winding nasal passages, is more efficiently warmed than it would be if it passed through the mouth, and at the same time the mouth is protected from the dessicating effects of the continual inroad of comparatively dry air.

The changes of the air in respiration are that the temperature of the expired air is higher than that of inspired air, that it is loaded with aqueous vapor, and is less in volume. Hence, when an animal is made to breathe in a confined space the atmosphere is absolutely diminished. The expired air contains from four to five per cent. less of oxygen and about four per cent. more of carbonic acid than the inspired air, besides vari-

ous impurities. The organic substances present in the inspired air are the cause in part of the odor of the breath. It is probable that many of them are of a poisonous nature.

The red blood corpuscles, by virtue of their hemoglobin, are emphatically oxygen carriers. Undergoing no intrinsic change in itself, the hemoglobin combines in the lungs with oxygen, which it carries to the tissues; these, more greedy of oxygen than itself, rob it of its charge and the reduced hemoglobin hurries back in the venous blood to the lungs for another portion. As the blood passes through the lungs, the low oxygen tension of the venous blood permits the entrance of oxygen from the lungs into the blood. Hurried to the tissues, the oxygen, at a comparatively high tension in the arterial blood, passes largely into them. The oxygen tension of the tissues is always low from the fact that they pack away in stable combination each atom of oxygen which they receive from the blood. How much hemoglobin is reduced will depend on the activity of the tissue itself. The quantity of hemoglobin in the blood is the measure of limit of the oxidizing power of the body at large, but within that limit the amount of oxidation is

determined by the tissue and by the tissue alone.

We have seen that the direct result of exercise was an increased demand for oxygen by the tissues, and to meet this demand respiration was deepened and quickened, and the beat of the heart was more rapid and more forcible. The phenomena of increased breathing power and increased heart action benefit other parts of the body. At the commencement of an exercise, the contraction of the voluntary muscles called into action compresses the blood-vessels and impels the venous blood actively toward the heart, which, thus stimulated, contracts vigorously and propels the blood in increased quantity to the lungs. Stimulated by the pressure of a large amount of venous blood, the inspiratory muscles contract and elevate the osseous structure of the chest, the diaphragm pushes down the abdominal contents, and the air rushes in to fill the cavity thus produced, and to supply the oxygen necessary for the purification of the blood. Supplied with this life-giving element, the blood is returned to the heart to be distributed again throughout the system, to restore the loss incurred in the original muscular movement.

In this manner not only are the voluntary muscles enlarged and strengthened, but also the involuntary muscles, particularly the heart and diaphragm. The increased activity of the circulation stimulates other organs to increased activity. The quantity of perspiration from the skin is more than doubled, the appetite is increased, digestion is more perfect, absorption is more rapid, the hepatic circulation is more active, and the abdominal circulation is carried on more vigorously.

But, on the other hand, actual harm may be done if anyone who has been accustomed to lead a sedentary life or who is not vigorous suddenly engages in the more violent forms of exercise. In this extreme exertion the heart may be embarrassed by the respiratory action. At the end of deep inspiration the increased pressure of the lungs impedes the flow of blood from the right side of the heart, while the compression of the heart itself by the distended lungs tends to overfill the large veins and to further endanger the right side of the heart. During general muscular contraction the arterial pressure is increased at the outset of the exertion, before the arteries have become relaxed, and this in turn

may lead to an engorgement of the left side of the heart and the circulation through the lungs. To these causes may be added another, that is, the exhaustion of the respiratory muscles, partly because of the unusual labor thrown upon them and partly from an inadequate supply of properly oxygenated blood. If the disturbance of the pulmono-cardiac equilibrium be severe and the condition unrelieved, general prostration ensues long before the muscles engaged in the work are exhausted. If, on the other hand, the equilibrium be restored, or, when the heart and lungs have been trained to accomplish the restitution, the distress disappears, and the individual is said to have gained his second wind.

It is self-evident that any restriction placed about the waist, by preventing the full expansion of the ribs and descent of the diaphragm, will further embarrass the heart's action by diminishing the amount of room it has to work in, while it decreases the amount of oxygen inspired, because the lungs have not sufficient room to expand. Great physical injury has followed women playing lawn tennis while tightly corseted. And while dancing is a much milder exercise, since it is carried on in an overheated and poorly venti-

lated room, we occasionally meet with fatal results from the same cause.

Consumption destroys fully one-seventh of our population. It attacks the crippled and poorly developed lung, just as certainly as it shuns the one which is fully expanded and in constant and active service. Numerous observations have established the existence of a constant ratio between consumption and deficient chest expansion. A chest expansion of less than three inches is incompatible with the full vigor of the adult woman.

A roomy thorax and a strong heart are no mean allies in resisting the assaults of disease. A few extra cubic inches of respiratory capacity, or a small reserve of disciplined cardiac power may suffice to determine a favorable issue in pneumonia, pleurisy, or typhoid. Every inch which a woman adds to her chest measure adds to the measure of her days.

The capacity of the lungs is about two hundred and thirty cubic inches. Of this amount of air, about one hundred cubic inches remains constantly within them and cannot be expelled. It is renewed very slowly under the law governing the diffusion of gases. About one hundred

more cubic inches is more rapidly changed, as it can be taken in and expelled by means of forced breathing. During ordinary inspiration, however, only about twenty or twenty-five cubic inches of air is inhaled, and only about one-tenth of the whole renewed. In many persons the apices and small sections of the circumference and bases are very little used, and it is very suggestive that these are the very portions of the lungs which are first seized upon by consumption.

Prof. Brown-Séquard, condensing the watery vapor coming from the human lungs, obtained a poisonous liquid, capable of producing almost immediate death. He injected the fluid under the skin of a rabbit and the effect was speedily fatal. This eminent physiologist said that respired air contained a volatile toxic principle far more dangerous than carbonic acid. Many of these substances can be detected by neither smell nor taste, and are inhaled without any knowledge on the part of those who breathe them; while the organic matter has a fetid odor, and hangs about the room like clouds of tobacco smoke, and this odor is very difficult to get rid of even by ventilation.

If the sense of smell is constantly ignored, it

becomes blunted or is dulled by constant contact with the same odor. If not suppressed, the sense of smell is persistent in its warnings and adds an actually increasing discomfort that compels recognition. While the dulled sensibilities give no warning of the danger, and the individual does not feel conscious of the harm, although the nerve centers may be greatly depressed, it does not always follow because pain and discomfort have not been experienced in a vitiated atmosphere that no harm has been done. The effects may be slowly and imperceptibly cumulative, but are on this account none the less injurious, and are now recognized as being among the most potent and widespread of all the predisposing causes of disease.

Man breathes from sixteen to twenty times every minute, and the girth of the chest should increase three inches at every inspiration, when he should inhale one pint of air. Air is a compound of oxygen and nitrogen; the oxygen is the life-giving principle, but when too condensed it acts as an irritant, hence, in the atmosphere, nitrogen is used to dilute it. Our very life depends on fresh air to supply this oxygen and to get rid of the carbonic acid which has been

formed in the body. Fresh air is by far the most important part of our daily food. We have seen that it was in the laboratory of the lungs that the blood threw off its carbonic acid and other impurities, but it is only able to do this when the lungs are supplied with an abundance of oxygen.

The only way a sufficient supply of oxygen can be procured is by taking *active* exercise every day in the open air. Outdoor life is both the best prophylactic and curative remedy in all known diseases of the respiratory system. The average duration of life in various countries in the old world depends not so much on climate peculiarities, or their respective degree of coldness, as on the chief occupation of the inhabitants.

With the exception of deep-seated breast cough, "colds" may be nipped in the bud by a few hours of hard, *sudorific* work in the open air. It may be a heroic cure, requiring a good deal of will power in cold weather, but it is an infallible and the only radical remedy. In half a day the nasal ducts and the respiratory exhalants will throw off irritating matters which would defy the drug doctor for a couple of weeks.

Even a small excess of carbonic acid interferes

with healthy physiological action, by preventing a sufficient exhalation of the gas itself, thus causing an undue accumulation of it in the blood, and by lessening the amount of oxygen absorbed, thereby retarding those oxidizing processes which are requisite for the complete elimination of effete matters from the system. This failure in the aëration of the blood interferes with the nutrition of the whole system.

The bad effects of breathing impure air are shown by headache, dizziness, heaviness, and sometimes nausea. Anyone who continually breathes a vitiated atmosphere becomes pale, loses her appetite, and after a time there is a decline in muscular health and spirits; of the special diseases caused that of the lungs is the most frequent, consumption being the greatest scourge of the race.

The common causes of impurity of the air are the expired air and the transudation of the skin, the products of the combustion of lights, the effluvia of simple uncleanliness of rooms or persons, and the products of the fluid or the solid excreta retained in the room. In addition, there may be special conditions which allow the impure air to flow into the room, as from the basement

or cellar of a house, from imperfectly trapped soil and waste pipes, or from other impurities outside a house.

As the air contained in an inhabited room cannot under the most favorable conditions be kept as pure as the outside air, the object of ventilation is, by the admission of pure external air, so to minimize the impurities that the air respired may not be detrimental to health. To this end the amount of air supplied to an inhabited room must be sufficient to remove all sensible impurity, as judged by a person coming directly in from the open air. The air must not only be without odor, but also perfectly fresh. Attention to the humidity of the air is also important. Very dry air, as in winter, when a house is artificially heated, is irritating to the respiratory system, and often causes a sense of oppression and difficulty of breathing.

To maintain a healthy standard of the air of a room, there must be a constant access of fresh air to the room. A simple and a rather primitive way to secure this is, by raising the lower sash, a strip of wood, the exact width of the window, may be placed under it. The air will then pass through the space between the upper and lower

sashes. Some such or any better method of ventilation should be in continuous use, day and night, when the room is occupied.

The most rapid way to change the air of a room is by opening the doors and windows of a room opposite each other; remembering that the heated, foul air of a room rises toward the ceiling, the window should be opened from above as well as below. This mode of ventilation should always be resorted to for about one hour in the morning. And if the sitting and bedroom be the same, the room should be again well aired before going to bed. Otherwise the air will be impure, and the temperature too high to be conducive to refreshing sleep.

Every room should be provided with a thermometer which should register in the sitting-room from 68° to 70° Fahrenheit, depending on the occupation and health of the occupant, while in the bedroom it should not go below 60°.

Draughts are to be as zealously guarded against as impure air, always carrying with them as they do the danger of lung diseases, neuralgias, rheumatism, paralysis, etc.

In the ventilation of a house it should always be borne in mind that the cellar is the most im-

portant part. For as the heated air is conducted by pipes from a furnace all through the house, so all the foul smells of a cellar permeate the entire house. Open fires form the best ventilators, but the most inefficient means for heating. It has been estimated that in the ordinary fireplace seven-eighths of the heat passes up the chimney.

The living room should be bright and sunny; when possible, it should have a southern or eastern exposure. We have seen what vigorous races the Greeks and Romans were. But, even in that glorious climate, the Roman epicureans constructed special *solaria*, glass-covered turrets, where they could bask in the full rays of the sun.

When the air of a room is fresh and pure, the human system is furnished with all the oxygen it can consume, and heat is thus produced in the body, so that a lower external temperature is necessary for comfort. Hence, supplying fresh air minimizes the amount of coal consumed, besides increasing the vigor of the body.

Every individual should have a bed to herself, as is the custom in Germany. To sleep in the room with a consumptive is a pretty certain way to take the disease. Wherever population is dense, or sleeping rooms ill-aired or over-crowded,

consumption prevails. A room in which a consumptive person sleeps is reeking with contagion, if the air he exhales is not carried off.

The importance of a proper ventilation of the sleeping room will be seen from the one fact that two-thirds of the oxygen absorbed in the twenty-four hours is absorbed between six o'clock in the evening and six in the morning. During sleep inspiration occupies ten-twelfths of the respiratory period, while at other times occupying only five-twelfths of that period. In a closed room the oxygen would be eventually consumed, the air become filled with impurities, and the body languish for want of oxygen and incapacity to throw off its impurities. At the same time, the rashness of throwing wide open the windows or even window of the sleeping room on a winter night is to be equally avoided; this would often mean gales of wind; at least, heavy draughts and a too great fall of temperature. And a great fall of the temperature of the air breathed at night is highly detrimental to the perfect running of the machine. Instead of good being accomplished, the friction thus caused will be detrimental to the vitality.

On leaving the bedroom in the morning the

bed-clothes should be thrown well back, in order that, with open doors and windows, the rapidly changing air will carry away all impurities from night garments, bed-clothes, and mattress. For the same reason, the clothes worn during the day should be hung up in the room at night in order to be well aired, instead of being hung up in a close wardrobe or closet, or being flung in a heap on a chair. It is taken for granted that in this enlightened age, no one would think of wearing the same undergarment at night as in the daytime.

"Perfect health depends upon a daily supply of fresh air as much as on our daily bread."—Felix Oswald, M. D.

VENUS DE CAPUA.

CHAPTER V.

Dress—The Fundamental Cause of the Physical Deterioration of the American Woman—The History of Woman's Dress—The Influence of the French Court on Dress—The Çorset—Hygienic Dress—Decolleté Evening Dress—Artistic Evening Dress.

"O woman, lovely woman! Nature made thee to temper
man;
Angels are painted fair, to look like you;
There's in you all that we believe of heaven,—
Amazing brightness, purity, and truth."

—THOMAS OTWAY.

"Woman—God's best gift to man and the chief support of the doctors."—*The Annual Toast at Medical Conventions.*

"A Turkish woman once told a missionary that she never knew what it was to be sick until she became a Christian and wore corsets."—ANNE JENNESS MILLER.

THE history of woman's dress furnishes us with the key which solves the problem of the difference in physique of the women who posed for the Junos, Ariadnes, Venuses, and Madonnas, and the American woman of to-day who poses as "the chief support of the doctors."

The difference in their dress is as striking as the difference in their physique. The dress of the Greeks when at the height of their civiliza-

tion—and that of the Assyrians, Egyptians, and ancient Romans was not essentially different—was very simple, often consisting of a single garment, the tunic, which pleased the eye by the gracefulness of its drapery, and at the same time was comfortable by reason of its looseness.

There were two distinct styles of "tunic," one, the short and sleeveless, being admirably adapted for working purposes, since it only came down to the middle of the thigh and was slightly confined at the waist by a girdle; the other was long and has remained noted for the rare beauty and grace of its draping. The tunic was made of two square pieces of cloth sewn together. The long tunic reached to the feet; it was worn loose, confined by a girdle at the waist, and sometimes there was a second girdle lower down. While the long wide sleeves were clasped on the shoulders. The girdle was nothing more than a loose cord or a narrow tape.

Sometimes there was worn a light creamy stuff next the skin, which fitted the body closely. The peplum or mantle was the outermost garment used by both sexes, but mostly by the elders and on occasions of ceremony.

From the time of Pericles, the great European

GREEK COSTUMES.
"Queen and two attendants."

FASHIONABLE COSTUME OF TO-DAY.

distinction between male and female dress consisted in the length of the skirt; old men, priests, and officials being allowed the privilege of wearing long or women's skirts, and young girls being permitted to wear the short or man's skirt. Among the Romans, this single garment, worn by both sexes, was called the toga. The Greeks wore sandals and occasionally went barefoot.

As time rolled on the loose cord which had formed the girdle was reinforced by a broad belt or band to support the breasts. Among the Assyrians this belt was made of stiffened linen or thin metal; the Egyptians wore a folded belt; a broad belt for supporting the breasts was also used by the Roman ladies. But whatever the material used, this stay belt does not show any signs of tight laces or of vertical ribs of iron or bone. It was, however, the forerunner of "stays." And when the moral fiber of the Greeks grew lax, the courtesans set the fashions and dress was used to display rather than to conceal the figure. And in order to make the hips more prominent the waist was constricted by a many-layered belt. At the same time the use of cosmetics was introduced.

In following the history of the male attire, we

find that "dress proclaims the man" and the kind of life that he leads. In marked contrast to the loose flowing robes used by the Southern nations of Europe in their decadence, were the short skirts and jackets clinging to the limbs, which were worn by the hardy nations of the North, who were given to constant fighting and the pursuit of the chase. The Norman lords, following the fashion of the South, swept about in long tunics and flowing robes.

In the twelfth century the Anglo-Saxon women in their loose garments were indebted to the Norman ladies for the introduction of "stays," and the fashion of tightly lacing the body with a robe laced down to show its undulations, as well as the use of cosmetics. Thus for seven centuries the French court or its representatives have been the acknowledged leaders of fashion.

In the British museum there is a manuscript of the time of Edward the Confessor, 1042–1066 A. D.—he had spent his youth in exile at the court of Normandy—which contains a picture of the fiend of fashion. The figure wears an unmistakable corset, tightly laced and stiffened. In the household register of Eleanor, Countess of Leicester, which bears the date of

May 24, 1265, is one of the earliest places in which the word *corset* occurs. The word is again found in reference to the wardrobe of Richard, king of the Normans, and Edward, his son. The latter died in 1318. Corsets were at this time worn by men as well as women.

In the fourteenth century the Emperor Joseph of Austria became so alarmed by the fascinating lures thrown out by sirens for the capture of mankind, that he issued a special edict, forbidding the use of the corset in all nunneries and places where girls were educated; and called upon the Church to aid him, threatening excommunication to those evil-disposed damsels who should persist in operating on their waists. The College of Physicians of that day took up the subject with activity and zeal, and dissertations upon the evil of tight-lacing were scattered broadcast.

The sixteenth century was indebted to no less a personage than that forceful queen, Catherine de Medici, who made France to flow with blood, for the invention of a corset which resembled in more than looks that instrument of torture, "The Machine Virgin of the Inquisition." This corset was made of steel and was as inflexi-

ble as a suit of armor, and like a warrior's breast- and back-plate, consisted of two pieces. It opened longitudinally by hinges, secured by a hasp and pin, made like an ordinary box fastening. In the front and back a rod or bar of steel projected in a curved direction downward, and on their bars depended the adjustment of the long-peaked body of the dress and the set of the skirt behind. Perhaps it was just a little due to these same corsets and also to the fact that during the forty years in which she ruled at court, a thirteen-inch waist measure became the accepted standard, that this queen died "universally execrated."

The impression which this extraordinary woman made on the bodies of her subjects was second only to that which she made on their minds. And we are not at all surprised to learn that Mme. de Sévigné, born thirty years after the death of Catherine de Medici, formulated the axiom which has ever since been a law to the French modiste: "Les hommes ont la permission d'être laid, les femmes ne l'ont pas; aussi n'en est-il aucune qui consente à l'être."

Dr. Fanton (Marseille Médical, 1879, 16, 708) does not give his countrywomen, or, indeed,

LADY OF FASHION, 1894.

ARTISTIC DRESS.

women at all, the credit of having gained any wisdom in the last three centuries in which medicine has been placed on a scientific basis, and science has advanced so far. For he says that this same axiom, formulated by Mme. de Sévigné, is still held as such, and then goes on to add, if there are any charms which nature has refused a woman, "il n'est rien que celle-ci ne fasse pour y supplier, il n'aucune sacrifice devant lequel elle recule, fasse même de la santé." Now as hygiene is the basis of morals, that does not speak well for the morals of the woman of to-day, and less for her knowledge of what really constitutes true beauty.

But to return to the sixteenth century, when men as well as women were still torturing their bodies by the wearing of corsets, we find that the reign of Queen Elizabeth was marked by the first use of whalebone stays. These were much affected by her successor, James, who insisted that all his courtiers, male as well as female, should cultivate the appearance of the wasp. The corset of George II., represented in Hogarth's pictures, is said to have been one of the most harrowing forms of screw torture. We are told that the doughty warriors of

Gustavus Adolphus wore stays almost to a man.

The Renaissance, marked by the accession of Henry VIII., gave birth to the general style of dress that still holds to-day. But at just what period our brother man became emancipated from the corset we are not told. Be that time when it may, he seems to be getting along to-day bravely without it. Although doubtless, at first, when his corset was taken from him, he too felt that he had lost the best bone in his body.

Truly "there is nothing new under the sun," for when the physician of to-day calls the American woman a "sham," which he sometimes does, he is only repeating the complaint of a husband of the olden time who declares that he has married a "sham," a lady of comely proportions who *en déshabillé* shrank into a dwarf. Her headdress measured eighteen inches, her shoes elevated her six inches. Her circumference decreased as alarmingly as her height, for on the removal of the stomacher and hoop, the stately pyramid of silk and satin who had swept about all day dwindled into an insignificant pigmy of half her artificial size.

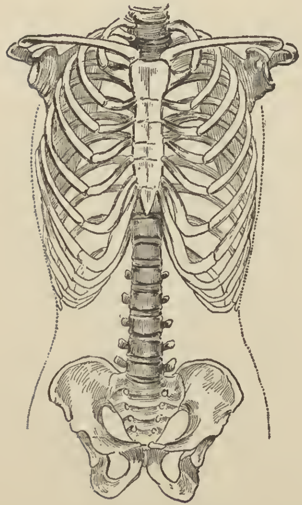
When traced to their original sources, we find that all the extremes of fashion were made either to conceal some deformity of the figure, or to give to a part of it undue prominence, as in the case of the corset, which was instituted at a time when clothes were not wanted for the concealment of the person, but for its display.

The ruff grew out of a scrofulous complaint on a royal neck. The hoop-skirt to hide the *enceinte* condition of a French queen.

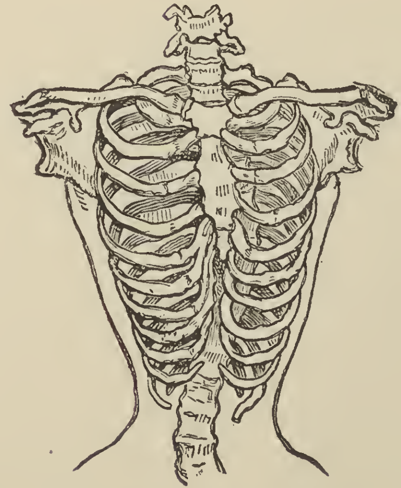
From the time of Galen, A. D. 130, to the present day, in spite of all the anathemas hurled against it, and that all the departments of medical science recognize and denounce this great injury which woman does herself, has the corset still prevailed.

The greatest living pathologist, Professor Virchow, says: "What is the use of introducing the principles and appliances of hygiene into the huts of the poor and ignorant, when the scions of wealth, pretended intelligence, and fashion, especially in the gentler sex, show their contempt of hygiene by their dress and general wearing apparel! In days gone by I have battled against the diabolical invention called the corset, but this crusade has been given up by me as absolutely futile."

The secret of the failure of their anathemas to remove the corset from woman's dress is manifold. First, for the most part they were hurled against tight lacing; and although great distortion of the body due to corsets has been found after death, deep grooves in the liver caused by the pressure of the ribs, and in a few instances the left lobe of the liver has been found to be nearly separated from the right, these must all have been curious *post-mortem* changes. For that woman has never yet been found who laced *at all.* Second, habit breeds custom. Women, or rather girls wore corsets because their mothers had worn them. While their mothers had grown so accustomed to this grotesque deformity, and the true ideal of beauty was so completely buried in oblivion that mothers encouraged their daughters to put them on while young, so as to better mold the figure. Third, for the most part woman has been allowed to sin ignorantly. Anatomy and physiology, with still less hygiene, as taught in girl's schools, was a merest smattering. She has known that she was the unhappy possessor of certain organs, but in what way they acted or where they were located was quite another matter. In the fourth place, she was led to be-



I. NORMAL CHEST.



2. EFFECTS OF TIGHT-LACING ON BONY THORAX.

lieve, by some of these very same men, that she was a victim to her functions; a woman, ergo, an invalid. And lastly, gymnasiums for women are only just old enough to show that the physical deterioration caused by centuries of improper modes of dress and life can to a great extent be overcome, and that the question of her physical development lies in her own hands.

The remarks which follow are not for the benefit of the woman who tries to reduce her waist to a certain standard number of inches, but for the woman who wears a corset at all.

The peculiarities of the bony chest are that it is distensible; the vertebræ form a fixed point and the breast bone a comparatively fixed one, upon which the ribs move up and down in respiration; at the same time the muscular base of the thorax, the diaphragm, is constantly ascending and descending. As it descends, it carries with it the heart and lungs, and on rising, restores them. The heart makes a descent of one and a half inches eighteen times a minute, and the liver and stomach two and a half to three inches. The thorax extends down to the tenth rib, while the eleventh and twelfth ribs float freely in the abdomen.

A corset, even when loosely worn, acts to a certain degree like the surgeon's splint which he

CORSETED FIGURE.

applies to immobilize the thorax in case of a broken rib. The whalebone corset of to-day is

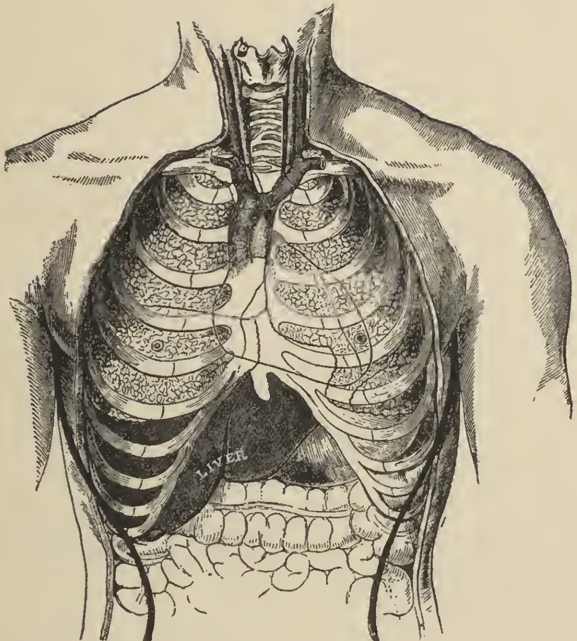
supplemented with steels. The heaviest pair of steels, which measure from one and a quarter to one and a half inches, are in the median line in front. These steels are so heavy that the desired "mold" is given to them by machinery. This strong, unyielding band of steel passes over, if not presses upon, certainly does not yield to the liver, stomach, large and small intestines. Other steels does the corset possess to the number of six, four in the back and one under each arm, each of them measuring half an inch. In addition to this, "firmness" is given to the corset by the closely set whale-bones.

This corset splint is fitted during quiet respiration, and generally when the stomach is empty. On eating, be it remembered that the stomach turns on its axis, so that the greater curvature shall be anterior where there is more room for digestion to be carried on. Now, where *can* the fashionable woman's stomach turn to while she eats her dinner, or how will the liver be able to receive the blood laden with the products of digestion?

You would take a rapid walk, a ride on horseback, or play a game of tennis. All of these exercises call for the utmost chest capacity for

the play of heart and lungs, that is, a capacity for enlargement of the under-arm girth of three inches, and of the waist girth of from three to four inches. But you have limited the action of heart, lungs, and muscles by your corset splint. For the best corsets are made of the best quality of steel, whalebone, and French jean, and are so made that they will hold their shape; in other words, yield to nothing, but mold the figures to them.

On disrobing, you will readily perceive this zone of compression by the purplish band on the skin from three to five inches wide, showing the creases and pattern of the undergarment. This zone extends from the sixth to the twelfth rib, which is directly over the location of the diaphragm, so that not only can the lower ribs not rise in forced inspiration, but the diaphragm cannot expand. The intercostal spaces are narrowed, the tidal capacity of the lungs is lessened. The heart's action as a suction pump is impaired. In early youth the heart lies higher than in the adult. By narrowing the intercostal spaces the heart is retained, as it were, in its youthful position, and its descent interfered with. In the adult female it is found to lie higher than in the male. This



RELATION OF BONY THORAX TO LUNGS, HEART, LIVER, AND STOMACH,

With artificial outline produced by corsets.

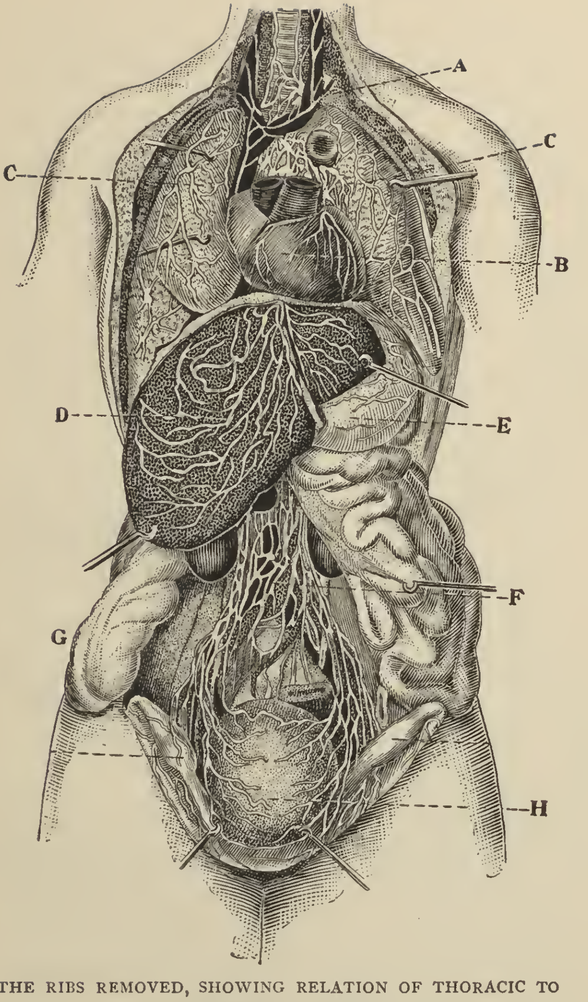
encroachment of the chest wall on the heart is one of the causes of woman's fainting, as well as of those well-authenticated cases in which it was the cause of death, brought on by some unusual exercise, as in dancing. It is also one of the causes of organic diseases of the heart.

How seriously the corset interferes with the expansion of the lungs is shown by some experiments of Dr. Sargent's in a paper already referred to. He found that the average lung capacity when corsets were worn was 134 cubic inches. When corsets were removed the test showed a lung capacity of 167 cubic inches—a gain of 33 cubic inches. That is, the woman who wears corsets cripples her lungs to the extent of one-fifth of their entire capacity. Nature endeavors to make up this loss by an increased rapidity of the heart's beat and more frequent respirations, but this is at the expense of greater and unnecessary wear and friction of the machinery. Palpitation and shortness of breath follows, and the woman is obliged to give up everything that is worthy of the name of exercise. Through this failure of the suction power of the heart there are disproportionately large lower limbs and an accumulation of adipose below the waist. This condition

is much more common in women than in men, and is due to the lack of power of the heart to draw the blood back from the lower limbs to the center of the body, against the influence of gravity. Hence the blood tends to linger in the extremities and oxidation of the tissues is interfered with. But most harassing of all are the distressing symptoms caused by the irritation of the nerve centers by the accumulation of carbonic acid, and the retention of other excrementitious matter in the blood—symptoms fully as distressing as those caused by true organic lesions.

The anterior surface of the body should in the median line present a gentle curve from the upper end of the breast-bone to the brim of the pelvis, the convexity of the curve coming about the umbilicus. An *inward* curve of this line is a deformity artificially produced.

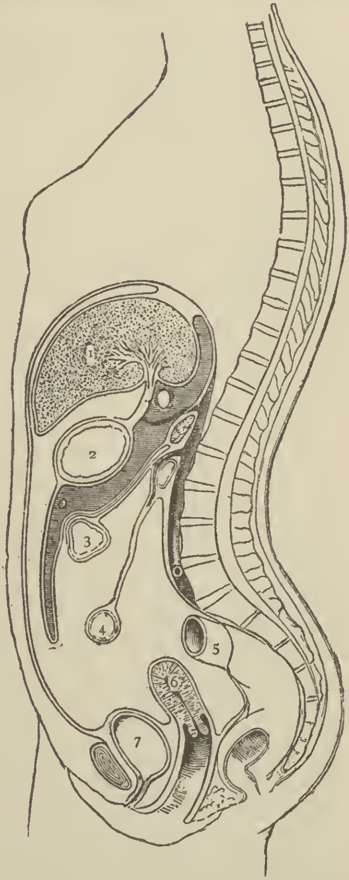
The pressure on liver and stomach, great as it is in standing, is increased in sitting. The diaphragm, not being able to expand laterally, expends its crippled power on the liver and stomach. In writing or sewing the wearer bends against the upper end of the corset steels; this pressure, in turn, is expended upon the lower end. So that in bending forward even the very



THE RIBS REMOVED, SHOWING RELATION OF THORACIC TO ABDOMINAL VISCERA.

A. Trachea. B. Heart. C. C. Lungs. D. Liver. E. Stomach. F. Small intestines. G. Large intestines. H. Bladder.

loose corset is brought against the yielding parts of the body. We have seen that the original design of the corset was to give undue prominence to the hips and abdomen; but the lower end of the corset presses the abdomen inward, so that the contents are pushed in the only direction left, that is, down on the uterus and other pelvic viscera.



ANTERO-POSTERIOR SECTION OF BODY.

1. Liver. 2. Stomach. 3. Large intestines. 4. Small intestines. 5. Rectum. 6. Uterus. 7. Bladder.

The array of diseases caused by the corset and which makes "woman the chief support of the doctors," is sufficiently startling. Lung and heart diseases, intercostal

neuralgia, dyspepsia, congestion of the liver, ulcer of the stomach, diarrhea or constipation as the case may be, floating kidneys, falling of the womb and painful menstruation, thinness of the blood, and diseases of the nervous system, verging on to nervous prostration. But why continue the list? These are a few of the pictures of the familiar friends of us all. This, over against the testimony of all travelers, that whenever women give free play to their lungs and stomach they grow as large or nearly as large as men.

We have seen some of the physiological results of wearing even a loose corset. There remains nothing further than to consider the results, from what Dr. Fanton says is a woman's ultimatum—the æsthetic.

The Greek is universally conceded to be the ideal type of beauty. The waist proportion of the Venus de Milo is 47.7 per cent., while that of the Grecian man is 46.4. In proportion to her weight, the hips of the modern woman exceeds that of a man's by four inches, and a woman of the same height as a man exceeds in hip girth by six inches. A woman's liver is proportionately heavier than that of a man. If the

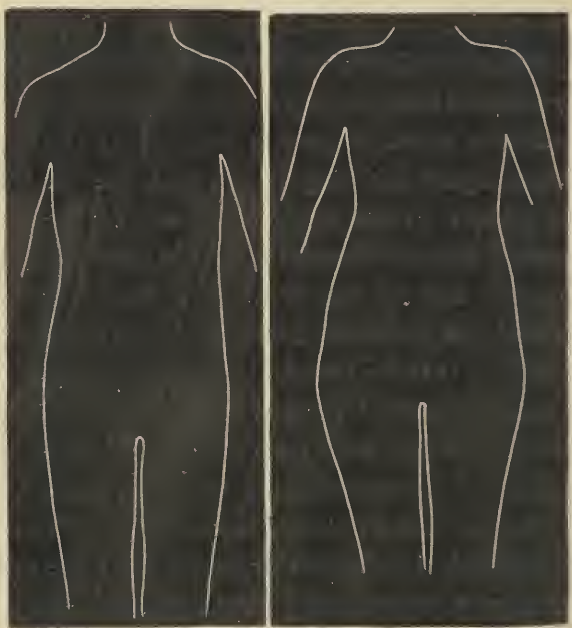
VENUS DE MEDICI.

muscles which pass from the thorax to the pelvis were left unrestrained and properly developed, the artistic proportions would be preserved, and the waist of the woman would then be proportionately larger than that of man. These ideal figures of the Greek women show a torso bounded by outward curves softly melting into one another until the broadest part is reached at the hips, thence again declining to the feet, the line from the armpit to the ankle being one of the chief lines of beauty in sculpture. We have seen also that the line of the front of a woman's body formed an outward curve, and no trace of a waist line is to be found.

A deformity is defined as any considerable deviation of the body from the natural form, as a clubfoot, a humpback, or a furrowed waist. No good artist will paint the laced figure. The subject must first hide with draperies what the artist considers a hideous deformity.

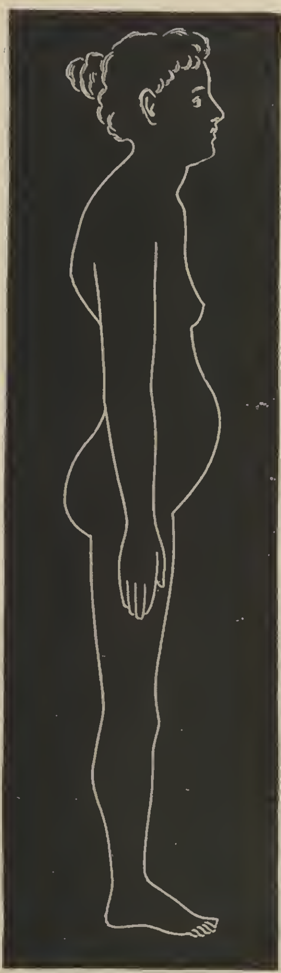
The pity of it is, if woman for all these years has purposely sacrificed health to the corset in order to increase the beauty of her form and enhance her charms, and has only succeeded in producing a horrible distortion! In addition to the deformity, there is a loss of suppleness in the

natural torso, and by damaging the health, a loss of facial beauty. By the diminution of the physical capacity which it causes, it lessens the

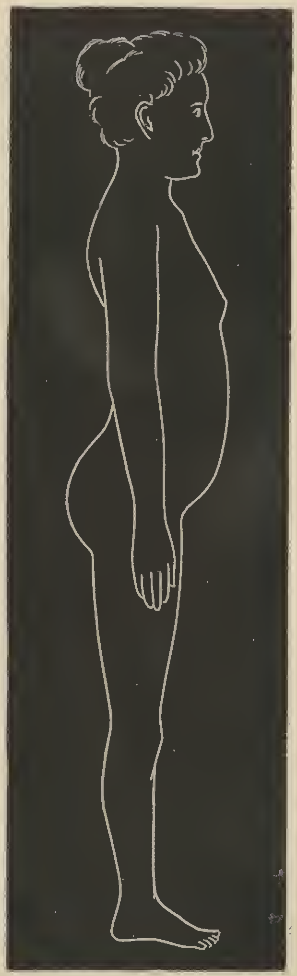


MAN. WOMAN.

mental ability, while it increases the mortality. It renders woman more impressionable than strong, transforming her into a feeble dependent. Whatever course of action the woman rolling in



EFFECTS OF CORSET AND TIGHT LACING.



THE SAME PERSON AFTER TRAINING.

wealth may elect to pursue, the woman who is obliged to do any kind of work cannot afford to cripple her resources in this way.

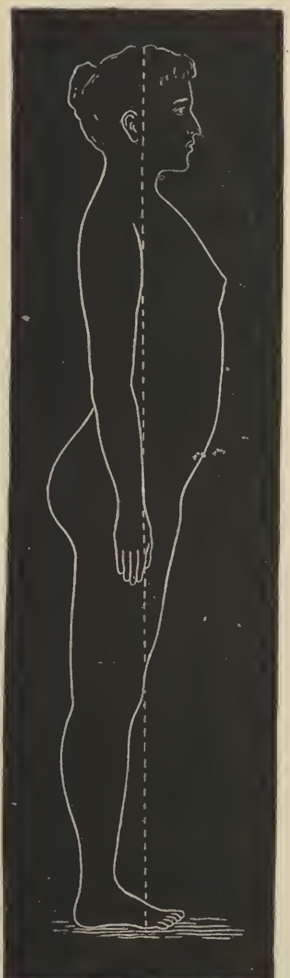
When she affirms that she cannot sit up or go without the support afforded by a corset, she presumes to affirm that she is the one creature that has been launched upon the world so ill-constructed that a prop is required to support its weight. Man donned the corset for the same reason that woman originally did, to increase the beauty of his figure, but finding it in his way he threw it off, and now gets along much better without it.

The first sensations of a woman who has worn a corset for years and then endeavors to go without one, certainly is that she will flop over at the waist. She feels as if the breast-bone in her body had suddenly been taken away from her. And this feeling simply confirms one of the evil effects of the corset. We saw the admirable arrangement produced by the crossing of the fibers of the three layers of abdominal muscles in every direction; that the trunk is kept from falling forward, not by the muscles on its anterior, but on its posterior surface; and that there were six layers of them. Now,

exactly the same thing occurs here that would occur if a surgeon should place an arm in a splint and leave it for an indefinite length of time. The muscles are restrained from action and they waste away. Precisely so with the muscles of the back: the corset holds the trunk in a rigid position; there is no opportunity for a play of the muscles. In addition to this, a woman's ordinary occupations with the needle or the pen bring into action the muscles in the front of the shoulders; so that with a semi-paralysis of those groups which should hold the shoulders back, there is an over-action of the ones which draw it forward, hence round shoulders and prominent shoulder-blades.

There is but one remedy: the corset must come off and stay off. For even if a woman had one hour's systematic training, and one hour's exercise in the open air every day, without corsets, it would not atone for the ten to fourteen remaining hours in which the corset is worn.

The evil effects of corsets are intensified by the bands of the skirts; the latter drag on the hips and weigh the woman down with heavier than maternal burdens. Where there is no interference with the respiratory process the uterus rises and falls with every breath. The move-



A GERMAN PEASANT WOMAN.

EFFECTS OF CORSET AND TIGHT BANDS ON AN AMERICAN WOMAN OF SAME AGE.

ment of the uterus assists in the circulation of the blood in the pelvis. The veins in the lower extremities are provided with tiny valves which have been likened to the locks in a canal; they dam it up for a few seconds' time that it may gain greater force and propelling power later. These valves greatly assist in propelling the blood back to the heart, but no such provision is made in the pelvis. Since the constriction about the waist interferes so greatly with the return of the blood from the lower extremities, how much greater will be the stagnation of venous blood in the pelvis, where the propulsive power is more inadequate!

Let a woman who has taken off her corsets and adopted loose and suitable clothing, or even clothing which is loose and not very suitable, record a careful measurement of the chest under the arms, at the ninth rib and at the waist, together with the state of the general health. At the end of a year, without having gone to a gymnasium, without medicine, change of scene, or rest, she will find that all these measurements have increased and there has been a marked improvement in her health.

But she will have gained vastly more if she has spent that year in a gymnasium, taking those

exercises which are especially adapted to strengthening the muscles of the back and chest. If a gymnasium is inaccessible she should take those same exercises systematically at home.

The stout woman's last feeble argument is that *she* must wear a corset to support the bust. There are many admirable hygienic corset-waists on the market that are sufficiently stiffened with cords to answer every purpose. If you will take off your corsets and take the proper kind of exercise, that mass of adipose tissue which now spoils your figure will disappear.

The skirts should be fastened to this corset-waist, so that the support shall come from the hips at the brim of the pelvis and not from the shoulders. The dress skirt is best supported in the back by being attached to the belt of the basque. So soon as a woman is conscious of the weight of her skirts, there is some failure in the mode of supporting them. In order to hold up a heavy skirt which is not fastened to the waist the skirt band must be so tight as to be absolutely injurious. Were the band sufficiently loose not to interfere with the vital mechanism during active exercise, it would produce an uncomfortable sense of dragging on the hips.

In exercising, even in walking, a woman is again placed at a disadvantage by the weight and length of her skirts. In walking, the length of the step should be proportionate to the length of the limb, which comes from the unconscious swing at the hip. The chief exertion in walking is caused by the raising of each foot and leg to the point at which it goes forward and downward. By this artificial shortening of the step, it requires much more muscular effort to walk the same distance. In addition to this, there is the resisting friction of the skirts, which, increased as it is by the slightest wind, has been likened to the pleasant process of eternally walking through a long field of grass.

The essential for winter clothing is that it must be light, loose, warm and equally distributed over the body. We have seen that much of the energy of the body is spent in maintaining the equable temperature of the body. If exposed to a cool atmosphere, the human body at once begins to lose heat by radiation, by evaporation of surface moisture, and by conduction or the direct conveyance of heat to the particles of air immediately in contact with it. When the body is clothed, the rate of conduction depends on the

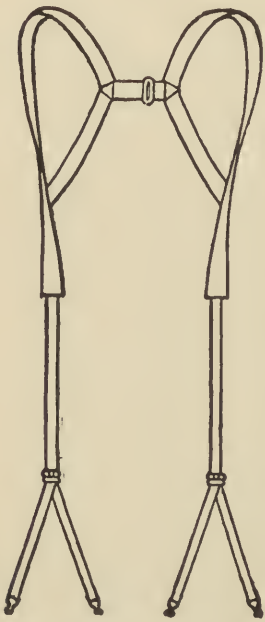
conducting power of the dress, so that the heat of the body is conserved by warm and moderate clothing.

Proper underclothing prevents the excessive formation of surface perspiration, and prevents sudden evaporation, which is one of the great causes of the chilling of the body. During exercise there is an increase of the heat production, hence the necessity of perspiration with evaporation from the surface of the body to maintain the average bodily temperature. But after the exercise has ceased evaporation continues until the body is chilled. Now, while wool is more impervious to cold than cotton or linen, it is also a poor conductor of heat. So that the vapor from the surface of the body becomes entangled in its meshes, and the large amount of heat which becomes latent when the water was vaporized is again given out. On the contrary, the perspiration passes through cotton or linen and evaporates from the external surface without condensation, and the loss of heat then continues. Besides excluding the cold or heat, as the case may be, and preserving the normal bodily temperature, an electrical action is caused by the friction of the wool against the skin, which promotes the

capillary circulation and stimulates the glands of the skin. On first putting on a woolen undergarment this friction may be very irritating and annoying to the wearer, but after a few days or weeks it passes off, to be followed only by a delightful sense of warmth. In our cold and changeable climate the most comfortable undergarment is the "combination woolen undersuit," which reaches from neck to ankles and has long sleeves. An additional good feature which many of these garments have is that they are double over the chest and abdomen, thus affording additional protection to the vital organs. Much greater warmth is afforded where the undersuit is moderately tight fitting. Such a suit, for the reasons above given, should be worn the entire year, the grade of weight being adapted to the season.

The feet are the part of the body to come into direct contact with the greatest degree of cold, whether on the floor of the house or the pavement of the street. Hence it is a matter of prime importance to the entire body that the feet should be properly clad. That we are dependent on the feet for the power of locomotion and exercise, without which the whole body loses tone and languishes, would be a sufficient

reason for seeking the welfare of these important members. Care must be taken to have the stocking sufficiently loose and long; since wool shrinks so greatly in washing, the greatest fault of the stocking is apt to be that it is too short. A tight stocking interferes with the circulation and causes a cold foot, just as a tight glove causes a cold hand. If the foot is already bound by a tight stocking, it will avail little that the shoe is of the proper shape and size. In order to hold up the stocking, a garter, whether above or below the knee, must be sufficiently tight to interfere with the circulation, and is a prolific cause of cold feet. That article of dress should be relegated to ancient history. The stockings should be supported by suspenders from the shoulders or corset waist, never from the waist.



STOCKING SUPPORTERS.

The shoe, being made according to the shape of the normal foot, should be sufficiently large, but at the same time tight enough at the instep to prevent the foot from slipping forward in the shoe, thus artificially producing the effects of a pointed and narrow shoe. The heel should be flat and large. While a French kid shoe is delightful for house wear or for summer time, for street wear, in the winter, a heavier leather with thicker soles is required, as a protection against cold and damp. On a winter's day an instructive study for the elevated car is the comparative weight of the covering for man's and woman's feet.

The street dress for winter should be warm enough to prevent a feeling of chilliness, and yet light enough to prevent rapid walking from being fatiguing. A woman should never be confined to the house simply on account of inclement weather. For this reason she must consider her wardrobe incomplete without rubbers and some form of "Mackintosh." But on no account, when she comes into the house, must she sit down before she has removed her damp skirts.

The décolleté evening dress is both unphysio-

logical and ugly. The entire arm and upper half of the chest are exposed, while the low bodice is held in place by shoulder-straps. In order to maintain the equilibrium of the body temperature the body should be equally clothed. If the décolleté dress were constantly worn it would be bad enough from a physiological standpoint, but the skin would grow accustomed to exposure; it would be a severe process of hardening, following the custom of the ancient Spartans; many would doubtless succumb, as they do now, but the survivors should be remarkably hearty. It is the covering up of a part and the uncovering it that is the most certain way to chill the surface. The heavy street dress is worn all day; then the woman of fashion takes off her dress that is now so extremely high and close-fitting around the neck, throws a loose wrap over the bare neck and shoulders, and goes out into the chill air of a winter's night. She dances in overheated rooms, and at some hour in the early morning returns home. Again she has wantonly taken life and health in her hands in order to display her charms. What, then, shall be said of the woman who is foolish enough by this mode of dress to display a rough and

DÉCOLLETÉ DRESS.

blotched skin, scraggy neck, and poorly-shaped arms?

But not only is there to be considered the danger of laying the seeds of disease from passing into cold air while the body is too thinly clad, but also the fact that to maintain the heat of the body in winter without the aid of warm clothing requires a great expenditure of nervous energy, which in turn is the equivalent of a large amount of life force. Not only is it imprudent, but positively injurious to exhaust unnecessarily the powers of the body, when mere mechanical appliances like clothing will obviate this continuous expenditure of vital energy.

Another way that clothes save the wear and tear of our bodies is by diminishing the amount of heat the system must produce by the oxidation of the elements of food. The more thickly clad we are the less urgent becomes the appetite for food, because the loss by cooling and consequently the loss of heat to be supplied by food is diminished.

According to Epicurus, the philosopher differs from the unwise man in this, that while both seek pleasure, the former has learned how to deny himself certain enjoyments which will cause him

pain and vexation hereafter; whereas a foolish man seeks only the immediate enjoyment, regardless of future pain which may far outbalance today's gratification.

By this décolleté style of dress a medium-sized or short woman has just so much decreased her apparent stature, as the neck of the dress is cut low. This effect is all the more striking if the dress is not white.

A much more becoming dress, and one that adds to the apparent height of the wearer, is one that is high at the back of the neck and is cut out in front so that it forms a graceful curve downward to the median line.

Instead of a covering of fur as a protection against the cold, to the human animal was given the power of reasoning and judgment, known as intelligence, and artificial coverings which could be nicely adapted to changes of temperature. But "free will" may prove a curse as well as a blessing.

It has been said that the work of the creation was in a constantly ascending scale. First to be created were the fishes of the sea, then the birds of the air, the beasts of the field, then man. And woman was the last and crowning piece of

the creation. And yet for centuries this superior creature has been distorting and deforming the various parts of her body, instead of having her clothing adapted to the form and development of the body as nature had made it.

"April 1st. This is the day upon which we are reminded of what we are on the other three hundred and sixty-four."

—*Pudd'nhead Wilson's Calendar.*

VENUS DE MILO.

CHAPTER VI.

Work, Recreation, Rest, and Sleep, in a Rational Combination as a Preservative of Good Temper and Good Health—A Definite Occupation a Physical Necessity—Number of Hours Allotted to Brain Work—Signs of Overwork—Physiological Necessity for Recreation—Number of Hours Required for Sleep—Health a Duty from an Ethical Point of View.

> ' From toil he wins his spirits light,
> From busy day the peaceful night;
> Rich from the very want of wealth,
> In Heaven's best treasures, peace and health."
>
> —GRAY.

> " Prevention is better than cure, and far cheaper."
>
> —JOHN LOCKE.

WE have seen that the anatomical structure of the bodies of women and men is the same; that in the early days of Greece, in the dawn of Christianity, and in the savage races of to-day, where the style of dress and the mode of life is the same, that women are as large and vigorous as men. Since the mind and body of both are governed by the same laws of physiology, we must conclude that if a definite and fixed occupation is necessary as a basis of morals in man, it

is no less so in woman. If the young man out of college, with no definite employment, find that "easy is the descent to Avernus," the young woman out of school just as surely finds that "idleness is the hotbed of hysteria, manifested in all manner of vaporish complaints, of many ills and evils, of inanity, if not of insanity."

When a girl leaves school, which she should consider the very alphabet of her education instead of the end of it, she should prepare herself for some definite occupation, some life work, just as her brother does. The vast majority of American women are obliged to do some sort of work in order to support themselves or help support their families. In addition, the conditions of social life in America are such that the woman of wealth to-day may be penniless to-morrow. There is yet a third class of women who are not obliged to work in order to support themselves, but who work from preference. And, indeed, the world has at last opened its eyes to the fact that all women cannot be ivies, because there are not oaks enough to go around. And what if your oak should be struck by lightning and you were left trailing on the ground to be trampled on?

For her physical well-being every woman should

have some definite work which she is *obliged* to do, the doing of which will afford her pleasure, and which at the same time will arouse her ambition. As an element of health, Elizabeth Cady Stanton places next to freedom of locomotion and individual independence, the necessity of remunerative employment and pleasant mental occupation.

THE IVY AND THE OAK.

"She twined herself around the strong, resolute man as the slender vine clings to the mighty oak for protection and support."
—*Popular Novel.*

Let every girl get the best possible education that her circumstances will permit. And the word education is used here in its full and broadest etymological significance, that is—to nourish the body, to develop the physical powers, to lead out and train the mental powers, to enlighten the understanding, to discipline the intellect, to form and regulate the principles and character, so to *round out* and to *perfect* both mind and body as to prepare and fit it for any calling or

business, or for any activity and usefulness in life. Keep ever before you the fact that the development of the mind and body go hand in hand, for these two are co-workers. In Greece both the philosopher and gymnasiarch gave instruction at the academy and lyceum.

A classical education added to a vigorous body greatly enlarges the list of occupations from which a woman may select her life work. It opens up innumerable avenues of enjoyment otherwise closed, and last but not least, it broadens the spirit, making the possessor more charitable and a better citizen.

Dr. Beard gives to the varied brain workers a value of life of fourteen years above the average. The brain-working classes are less disposed to worry, less apprehensive of indefinite evils, and less disposed to magnify minute trials than those who live by the labor of their hands.

In all avocations the cry comes up that women are underpaid for doing the same work as men. Heretofore they have not been equally well prepared for the work undertaken; now they are obliged to live down the reputation of doing an inferior quality of work. First, be thoroughly well equipped for the work you would undertake,

be it that of a cook or of a learned profession; then show by the way you do your work that you are a master workman. You will eventually become indispensable and can command your own price.

If you would be a success in your occupation, you must first nicely gauge your own physical ability. This you will do by a knowledge of your hereditary family history and your family physician. No woman who has weak lungs or in whose family there is a tendency to consumption should become a seamstress or a clerk in a store. Choose rather some active occupation that will call you out of doors as much as possible. Then comes the question of intellectual education and mental ability; undertake nothing that you are not well equipped for. To aim higher than is possible to reach is to waste strength in useless effort.

All occupations and professions are so overcrowded that competition is exceedingly keen; add to this that your work is going to be more strictly scanned from the very fact that you are a woman, and it is evident that in order to be an assured success you will need every possible advantage on your side. For it has been wisely

said that in order to succeed equally well a woman must do *better* work than her male competitor.

Again, in selecting an occupation, it must be one for which you have a taste or natural bent, an employment the very act of which will be a source of constant enjoyment to you, in the doing of which you become oblivious to everything else, even your own existence. It is an aphorism that no man can do well unless he takes a pleasure in what he is doing. With a distaste for the occupation selected, it becomes a very drudgery. In looking ahead over the possible vista of years during which you must continue at this same work, you grow disheartened and success becomes impossible.

And finally, in selecting an occupation be sure that the income from it will be sufficient for your absolute maintenance. Remember the axiom of Lord Lytton, "The chief part of one's expenditure is the unforeseen."

Having selected an occupation for which you are in every way adapted, in preparing for it do not overdrive and carelessly expose yourself. Be at least as thoughtful for your own future as the horse-trainer is for his horse. Always bear

in mind that the first requisite to success in life is to become a good animal. Let your powers be trained to act harmoniously, so that there need be no waste of effort in any direction.

Let not that woman who is going to become the head of a household think that she at least has no need of any particular preparation. It is one of the greatest fallacies of the day that women are born housekeepers, as too many unhappy homes in America testify. Housekeeping is a distinct and a very arduous occupation. On the woman of the family falls most heavily the burden of social competition; she must be able to turn a small income to the best account, by dexterity to make something out of nothing. It has been well said: "It needs the head of a diplomat to get hold of the money, and the wisdom of a commissary general to dispense it to the best advantage."

Assuredly for the physical well-being work is excellent *in moderation*. If you would accomplish anything worth while in the world, and be fit to live with, don't try to see how much you can do in twenty-four hours. You may succeed in running the machine at such a rate for one year that it will be so worn out by

friction that it will have to be laid aside for five years, if not for all time, before it can be used again. Try to break a tough cord and it is hard work, but keep it stretched to its utmost and it becomes an easy matter.

Brain work to be beneficial must be regulated with the utmost care. During the exercise of the brain there is always an increased blood supply to it. If the exercise is continued too long there is a tendency for the blood to remain in too great quantity, due to the exhaustion of the nerve cells which are no longer able to control the vessels. During sleep the blood supply to the brain is diminished, and the cells recover themselves. But if this hyperæmia of the brain be persistently kept up, sleep becomes impossible, the brain cells have no opportunity to become repaired, and their activity is diminished.

Richardson says (Long Life and How to Reach it, by John G. Richardson), "Making all allowance for differences, even in the prime of their mental and physical vigor, few individuals can exceed six, and for most persons prudence would direct not more than four or five hours of close mental application, without seriously endangering their health."

No real advantage is gained by eight to ten hours of daily study, since the memory and reasoning power become so exhausted that the assimilation of ideas becomes slower and more difficult. When in his prime Walter Scott declared that six hours a day was all that he could profitably spend upon his literary compositions. In later years, because of pecuniary embarrassment, he worked beyond this limit, and as the result of excessive labor, his last years were spent in hopeless imbecility.

Every individual runs a physical bank account, and every day she adds to, at the same time that she draws from it. But that it may be run on a satisfactory basis the average daily expenditure must not exceed the daily income. Further than this, everyone must have a reserve fund of strength in her body bank to meet emergencies, such as accidents, contagious diseases, periods of enforced overwork, etc.

Just as a firm may trade beyond its capital without any but the best intentions, so a woman may work beyond her strength, but the stability of the firm or of the individual is imperiled. Slight disturbing causes are more readily felt and their effects more serious.

As by means of a bill an individual is enabled to anticipate her income and draw upon capital, otherwise beyond her reach, so by stimulants a woman is enabled to draw upon her reserve fund. But unless these loans to herself are repaid, bankruptcy in the end is inevitable. A woman is physically exhausted; by means of a stimulant she accomplishes to-day work that otherwise would have been impossible. Her expenditure has exceeded her income. She has used to-day force that belonged to to-morrow. The process is not illimitable. Her capital is impaired—she becomes *invalid*. The bankruptcy is usually precipitated by some accident, some exposure, or a failure of the vital powers to accommodate themselves to severe changes of the weather. The unforeseen, unexpected expenditure works the woman's physical wreck.

It is not simply that a woman can live through a life which would have served her half as long again, and die worn-out because her physiological capital was spent long before its time, but that she may continue to exist bedridden for many years, or perhaps just able to drag around, or her last years may be spent in an insane asylum.

Signs of overwork show themselves in irrita-

bility, with a sense of exhaustion, the irritability being due to an exhaustion of the nerve centers. Work becomes irksome. There are periods of depression and melancholia which recur at shorter and shorter intervals, and continue for a longer time. There is slight loss of memory, together with inability to concentrate the mind upon any given subject for any considerable length of time, although the power of thought and judgment is not impaired. There are sleepless nights, ringing in the ears, fatigue from the slightest exertion, an irregular action of the heart with palpitation, and a frequent desire to urinate. Various forms of pain and neuralgias occur. There may as yet be no loss of flesh or impairment of the appetite. But this condition of cerebral anæmia furnishes the possessor with a pair of blue spectacles through which the intelligence must look, and which throw their own color over everything. Distressing dreams and unrefreshing sleep allow the brain little opportunity for either rest or repair. The mind becomes as sensitive as the skin after a blister. And the calm, vigorous mental labor is superseded by feverish anxiety, wearing responsibility, and vexing chagrin.

The human body is provided with two sentinels or guardians of its welfare. The first of these is Fatigue. This sentinel calls for a halt in order that the body may have time for needed repair. Force your way past this sentinel and continue on your way, and the next sentinel after the stage of exhaustion is past is Pain. And as Fatigue has pointed to the need of repair, Pain points to threatened or active injury to nerve tissues. Neuralgia or pain in the nerves is caused by mental pain in the brain cells. When they are well fed and fresh, the individual enjoys a feeling of *bien-être* and energy; when ill fed and exhausted, the contrary conditions of discomfort and languor exist. Anstie has called neuralgia "the cry of the nerves for food."

When the brain is well supplied by a powerful circulation, and a rich blood supply from a good digestion furnishes it with an abundance of pabulum, the cares of life are born with equanimity and cheerfulness. One of the most unerring signs of failing health is the inability to withstand the pressure of these same daily cares. When the cares that formerly sat lightly on the shoulders become a well-nigh unsupportable burden, a state has been reached where the mind

reacts on the body. Sudden grief or fright produces cold by arresting the circulation; and it may be retarded by anxiety. This result is brought about in a two-fold manner, the action of the heart itself is slowed, and through the nerves the caliber of the minute arteries is diminished. Instead of loading the body with clothing, the "chilly" should search out the physical cause of their coldness.

It is readily evident that worry is bred of exhaustion, but if indulged in it becomes a fixed habit, and the mind rapidly becomes settled in a state of gloom.

> "There's many a trouble
> Would burst like a bubble,
> And into the waters of Lethe depart,
> Did we not rehearse it
> And tenderly nurse it,
> And give it a permanent place in the heart.
>
> "There's many a sorrow
> Would vanish to-morrow
> Were we but willing to furnish the wings.
> So sadly intruding
> And quietly brooding
> It hatches all manner of horrible things."

Of all the mental attributes the emotions are the most exhausting. It is not the natural and reasonable intellectual work that injures the brain,

but the various emotions: ambition, anxiety, disappointment, the hopes and fears, the loves and hates of our lives, that wear out the nervous system and endanger the balance of the brain. A woman can spend more of her strength in five minutes of unnatural mental excitement than in a day of calm, steady brain work.

The center of the emotion of felicity is situated in the great ganglia of the sympathetic nervous system, lying near the stomach and on the heart. The opposite condition of a sinking at the stomach and a pain at the heart is known to everyone; while the seat of melancholy is situated under the lower ribs.

Richardson gives as the necessary requisites to secure felicity (B. W. Richardson, Felicity as a Sanitary Research), "First and most important, eight hours of sleep in the twenty-four; next to sleep, moderate and wholesome mental work: it strengthens the mind, it softens grief, it lessens care; third, physical work; fourth, strength of body. In other words, felicity is another word for health, and depends on the good working of the animal system."

When a woman is too exhausted to go any longer, she is very apt to rest by sitting down

and doing some necessary mending, instead of extending at full length on a couch or bed, and so being able to relax the wearied muscles of the back and arms and the back of the neck. Remember the Arabian proverb, "It is better, that is, more restful, to be sitting than standing, better to be lying than sitting, better to be asleep than awake."

The woman who is ambitious to accomplish the most and best work possible will find that one hour's rest at a fixed hour every afternoon will do far more for her than stimulants, and instead of breaking down under her work it will enable her to hold her own. In order to obtain the greatest good from this hour's rest, she must first have it understood by her friends and servants that during this time no one is to come to her room. Knowing that she will have no calls upon her breaks the *qui vive* which she is under for the rest of the day. Then, disrobing just as if it were night, she will lie down to sleep in a darkened room. On making her toilet after this, she will feel refreshed and invigorated and able to enjoy her work instead of "dragging around."

The daily siesta is good, but not sufficient.

History shows that the laws of all nations have prescribed a certain number of days of rest, or at least change of occupation, and that these days were fixed at more or less regular intervals. This was partly from a religious point of view, but it was also partly from a hygienic standpoint. The necessity of an interruption of the regular work has always been admitted and prescribed. Certainly as much care is due the human family as is given to horses. While this rest or change of occupation is essential to the well-being of every one, the failure to observe this law of nature is most severely visited upon the dwellers in cities who follow an intellectual or sedentary pursuit. For in both cases they are shut up in the confined air of a house, and the too-continuous application is apt to be followed by an impairment of digestion and loss of appetite and sleep. On the other hand, statistics show that the heaviest percentage of insanity falls on farmers' wives. The supposed cause of this is the monotony of their occupations.

The recourse to stimulants by day in order to accomplish the ordinary day's task, and sedatives at night to enable the individual to sleep, is both pernicious and irrational. The inert nerve

centers have no reserve of energy to give out, so it is worse than useless to stimulate them. In this class of cases alcohol cannot possibly be harmless. Over-stimulation of the lower centers is the evil to be avoided, and alcohol never increases the power of the higher centers; it only irritates them and in the long run interferes with their nutrition. On the other hand the nerve centers are at too low an ebb to be able to react from the depressing effects of sedatives, which to these individuals are positively injurious. The aim must be to promote nutrition, and the only way to do this is to naturally exercise the part to be nourished. A man's body, like his clothing, wears out in certain places first, and not altogether. Some organs degenerate from under-employment, others from over-use.

And this indicates the kind of recreation to be sought after. That is, to be healthful, recreation must be as its name implies, a process of recreating or reconstructing. An animal to be beautiful must possess symmetry. Anyone who devotes herself to an intellectual or sedentary pursuit must at the same time provide exercise for the body; while the woman who is engaged in manual labor must develop the mind by reading

and study. To class "fancy work" among the recreations for women is one of the machinations of the Evil One. It is a labor and a very severe one, and should be classed with hand sewing. It calls the same muscles into play and is productive of the same evils. It recreates nothing, but leads on to exhaustion, and if continued long enough produces a paralysis similar to "writers' cramp." The woman of sedentary occupation must have for her recreation something which will keep her on her feet, and call into play the various muscles of the body; while the housewife, who has been doing heavy manual labor, wants to make herself comfortable in an easy chair and forget her cares in a book or paper. The one class of women who can safely indulge in "fancy work" is that unfortunate class to whom the keen enjoyment of recreation is hopelessly denied, that is, the class who have no occupation.

The first thing which is necessary for a woman with a literary or sedentary occupation—and to the latter class belong clerks—to convince herself of is, that her feelings are no safe guide as to the amount of muscular exercise that is necessary to maintain full and sustained health. The system

accommodates itself to the neglect of sufficient exercise, so that not only may a desire for exercise cease to be a fair measure of its needs, but positive exhaustion may attend a much less amount of exercise than is necessary to a continuance of sound health. However strong a woman may feel in spite of her neglect of exercise, she must know that she is playing a dangerous game, which can only end in disease. Among women there is no other one source of disease and early death more prevalent than this habitual neglect of exercise.

Care must be taken that this recreation, which is at first an enjoyment and relaxation, is not turned into labor. The moment that anyone strains every nerve to excel in a game, that moment it ceases to be a relaxation. In order to obtain the greatest benefit there should be the greatest variety possible in the kind of recreation, to relieve the monotony and also to bring into action all the muscles of the body.

Pleasure days tend to offset the tedium of monotonous toil, as gymnastic exercises tend to counteract the influences of sedentary occupations. The Greeks and Romans both recognized the necessity. The Greeks had their monthly

holidays, beside their annual revels and great national festivals. The early history of the Romans shows that the rulers themselves provided the means of public amusements. At the time of the death of Septimus Severus, 211 A. D., the capital alone had six free amphitheaters and twelve to fourteen large public baths, where the poorest were admitted gratis, and no one else could complain of the half cent entrance fee to the luxurious thermæ.

It is a well-known fact that any one kind of crops will exhaust the best soil, but few people recognize the necessity for a change of occupation and recreation in order to produce the best mental and physical results. Joyless drudgery drains the springs of health. There is a mental starvation due to the lack of recreation, as well as the physical due to the lack of bread. The French aristocrats, noted for the gayety of their pastimes, in spite of dietetic and other sins, furnish a remarkable list of longevity. Persons of a cheerful disposition are generally long-lived, and anything tending to counteract the influence of worry and discontent directly contributes to the preservation of health. Despair can paralyze the energy of the vital functions like a sudden

poison, while hope fulfilled has cured may a disease. *Ennui* has never made a human being better or more industrious. The first Napoleon relieved the monotony of camp life with Olympic festivities, and in return could rely on his men to endure fatigues that would have killed the barrack slaves of his enemies. Fun and laughter are the most effective cordials of the Materia Medica, and tired humanity owes a deep debt to the guild of humorists.

> " Hang sorrow ! care will kill a cat,
> And therefore let's be merry."

A horse cannot gallop as many hours as it can walk, and a daily task is the sum total of what man or beast can do compatibly with health. To combine a day of toil with a second of amusement in one twenty-four hours does not give the proper allowance for sleep, and cannot be done without injury to the individual.

The amount of sleep required by the healthy adult is proportionate to the waste of vital strength, whether muscular exercise, intellectual labor, or emotional prodigality. The medical authorities of to-day are pretty well agreed that eight hours of sleep is the minimum required for

the maintenance of health. And all concede that the brain worker requires more sleep than the laborer.

During sleep the brain is in a comparatively bloodless condition. Dr. Caldwell records the case of a woman at Montpelier, who had lost part of her skull by disease, the brain and part of its membranes lying bare. When she was in a deep and sound sleep the brain lay in the skull almost motionless, when she was dreaming it became elevated, and when she awoke it became suffused with blood and seemed inclined to rise through the cranial aperture. (Psychological Journal, vol. v, p. 74.)

Every muscle or group of muscles has a distinct representative in the nervous system, to a certain extent in the spinal cord, and to a better determined extent in the brain itself. Experiments in blood pressure show that a change in the circulation takes place within the skull after every particular movement vigorously performed. In other words, a brain response is called out by every muscular movement.

Every moment after the feeling of languor presents itself is a strain upon the nerves and muscles, which will sooner or later invalidate for

life, and finally bring its victim to a premature grave. Habitual deficiency of sleep will undermine the strongest constitution. King Alfred, Spinoza, Kepler, Victor Alfieri, Mme. de Staël, and Schiller, killed themselves with restless study. Beethoven and Charles Dickens probably prepaid the debt of nature by their habit of fighting fatigue with strong coffee. On the other hand Mirabeau, Goethe, and James Quinn often slept from twelve to fourteen hours.

The Rev. T. DeWitt Talmage says, "Because Napoleon only slept three hours a night, hundreds of students have tried the experiment; but instead of Austerlitz and Saragossa, there came of it only a sick-headache and a botch of a recitation." And adds that he himself requires nine hours of sleep out of the twenty-four, eight at night and one in the afternoon. "If the world abuses us at any time, we go and take an extra sleep, and when we wake up all the world is smiling on us. If we come to a knotty point in our discourse, we take a sleep, and when we open our eyes the opaque has become transparent."

James Payn, the novelist and correspondent,

considers that for literary people ten hours of sleep is essential.

Study the habits of our slow-plodding, sturdy-bodied, European cousins and learn of them to mingle rest and recreation with work. No one goes at such a pace as the ambitious American, and so he finds only time enough to sip his enjoyments in a concentrated form. Recreation of the mind is too often bought at the expense of an overwearied body. This, instead of strengthening and refreshing the overworked nervous system, but fatigues it in a new direction. Experience has proven that even the most intelligent minds, although they seem lucky in the upward struggle, suddenly give out just as success is within their grasp.

"Neurasthenia" or nervous prostration first saw the light in the United States, and was christened by Beard an American disease that is absent from no household where the inmates use their brains. Who does not know the varied premonitory symptoms of this disease? the pressure of the head, feeling sometimes as if bound by a hoop, the pain in the back of the head and neck, ringing in the ears, sensitiveness to light, irritability, palpitation of the heart, cold

extremities, and various sensations of fear and oppression.

When the locomotive goes too fast and is not allowed proper time to rest between its trips, from the rapidity of the revolution of the wheels the axle becomes heated to such an extent that fire breaks out, which if not stopped may consume the train. But by turning off the steam, the motion of the engine, which has been whirling the train to destruction, is stopped.

To secure the best results and refreshing sleep, regularity in the hour of retiring should be observed. And active brain work must not be continued until bedtime, else the brain will be so active as to banish sleep from the pillow. The vigorous use of a flesh-brush, a few minutes of gymnastic exercise, a hot plunge, or a hot foot-bath, are no mean hypnotics. And it is only during sleep that the brain is absolutely at rest.

When the fall of mercury makes one bring out her winter clothing, there should be a heavy blanket placed between the sheet and hair mattress. Since hair is an excellent conductor of heat, it is very hurtful to have the body, the temperature of which falls during sleep, in direct contact with it. Women who are subject to

rheumatism and neuralgia should prevent the touch of cold, unsympathetic sheets, by sleeping in woolen nightgowns, as the inhabitants of foreign countries do. On getting into bed on a cold winter's night, the sensation produced should be that of delightful warmth stealing over the body, which is most conducive to pleasant and refreshing sleep.

"Now blessings light on him who first invented this same sleep! It covers a man all over, thoughts and all, like a cloak; it is meat for the hungry, drink for the thirsty, heat for the cold, and cold for the hot. It is the current coin that purchases all the pleasures of the world cheap, and the balance that sets the king and the shepherd, the fool and the wise man even." (Cervantes.)

Health gauges to a great degree the capacity for work as well as for happiness. So that by keeping our own health at its highest point of efficiency, we are able to do the most possible for the benefit of the community, by giving them the benefit of the best efforts that we are able to put forth. So that from a mere ethical point of view the care of the health becomes a most important duty. To this end there must be a careful study of all the laws of health.

THE SLEEPING ARIADNE.

Evidences of sound health are: first, individual adaptability or the capacity of the individual to easily adapt herself to extremely opposite conditions of existence; second, endurance, or the capacity to do a considerable amount of bodily or mental labor for a short time without suffering fatigue, or to be able quickly to recover from the fatigue; third, to be able to control the emotions; fourth, to be able to resist morbific influence, that is, a capacity on the part of the sound organs of excretion to quickly eliminate all poisons from the system.

The signs of debility are just the reverse: first, deformity, obesity, or leanness; second, personal inadaptability, that is, when physical or mental discomfort is caused by such slight provocations as change of food, clothing, or climate; third, lack of endurance, so that a long rest is required to repair the fatigue incident to slight exertion; fourth, lack of control of the emotions; fifth, a proclivity to morbific influences, so that the individual succumbs to every contagion or miasm that she encounters.

"A sound and vigorous body is a great help to clear thinking and sound reasoning, and a great incentive to right action. An enfeebled consti-

tution is a poor preparation for the race of life. When we consider what inroads are made upon the happiness of man by reason of pain and suffering, what limitations are plaçed upon his work on account of physical weakness and disease which might have been prevented by proper hygienic instruction, we shall realize more fully the importance of the subject." (Prof. A. E. Jones, Annals of Hygiene, January, 1889.)

"The proper study of mankind is man," and yet, with the accumulated wisdom of the centuries, how infinitely less does the average woman know about herself than any other subject!

"If you know these things, happy are ye if ye do them." (John xiii. 17.)

THE END